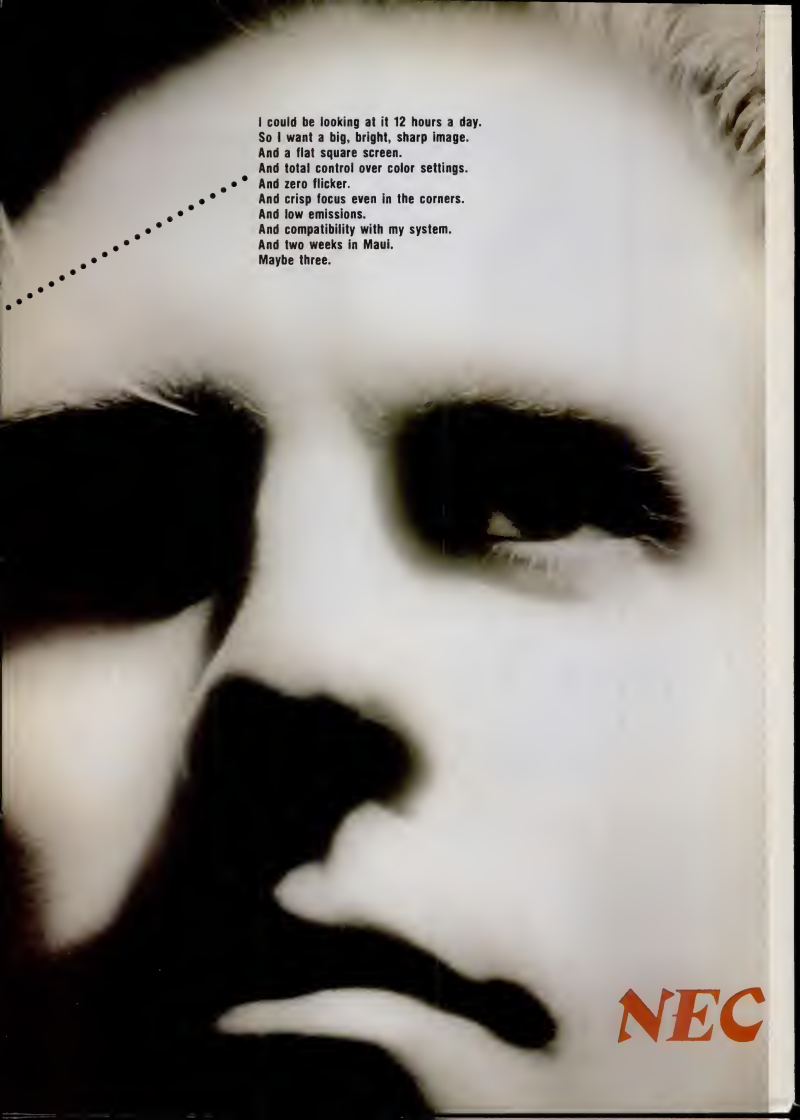




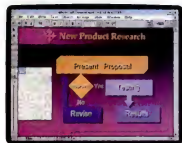
I could be looking at it 12 hours a day.
So I want a big, bright, sharp image.
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And low emissions.
And compatibility with my system.
And two weeks in Maui.
Maybe three.

NEC

Mary Sue Will You M

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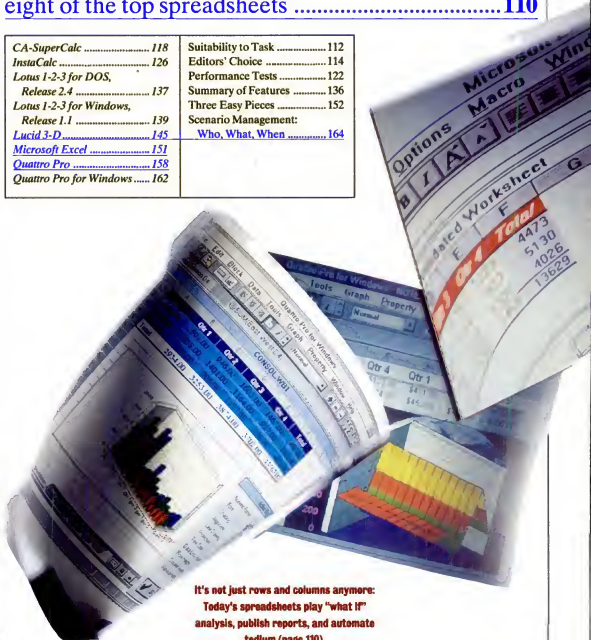
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The New Spreadsheets:
Diversity Blossoms amid
The Rows and Columns

BY CRAIG STINSON Ease of use, scenario management, object orientation, and a better connection to databases are among the features that power a new generation of spreadsheets. They make today's grids more than just number-crunchers. *PC Magazine* reviews eight of the top spreadsheets 110

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It's not just rows and columns anymore:
Today's spreadsheets play "what if"
analysis, publish reports, and automate
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Pen PCs

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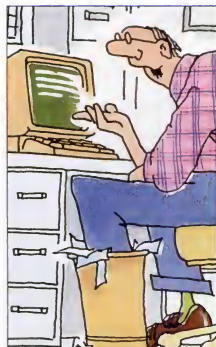
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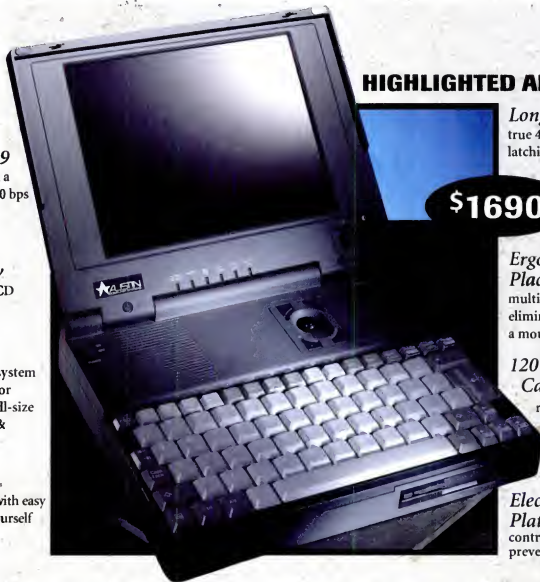
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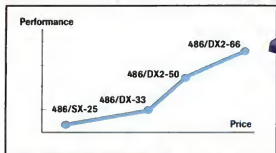
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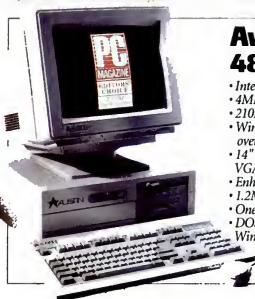


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PC Magazine Contributing Editor Winn L. Rosch



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Cyrix 486SLC, running at 33MHz 2MB RAM (to 32MB) 40MB Hard Drive 14" VGA 640x480 Color Monitor w/256K Video RAM 1.44MB & 7.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1/ Mouse Small Footprint Chassis	Intel 386, 33MHz w/64K Cache 4MB RAM (to 32MB) 80MB Hard Drive 14" VGA 640x480 Color Monitor w/256K Video RAM 1.44MB & 1.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1/ Mouse Small Footprint Chassis	Cyrix 486DLC, 40MHz w/64K Cache 4MB RAM (to 32MB) 120MB Hard Drive 14" VGA 640x480 Color Monitor w/256K Video RAM 1.44MB & 1.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1/ Mouse Small Footprint Chassis	Intel 486, 33MHz w/128K Cache 4MB RAM (to 32MB) 210MB Hard Drive 14" VGA 1024x768 Non- Interlaced Color Monitor w/Windows Accelerator 1.44MB & 1.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1/ Mouse Small Footprint Chassis	Intel 486DX2, 50MHz w/128K Cache 4MB RAM (to 32MB) 210MB Hard Drive 14" VGA 1024x768 Non- Interlaced Color Monitor w/Windows Accelerator 1.44MB & 1.2MB Floppy Drives 101-Key Keyboard DOS 5.0/Windows 3.1/ Mouse Small Footprint Chassis
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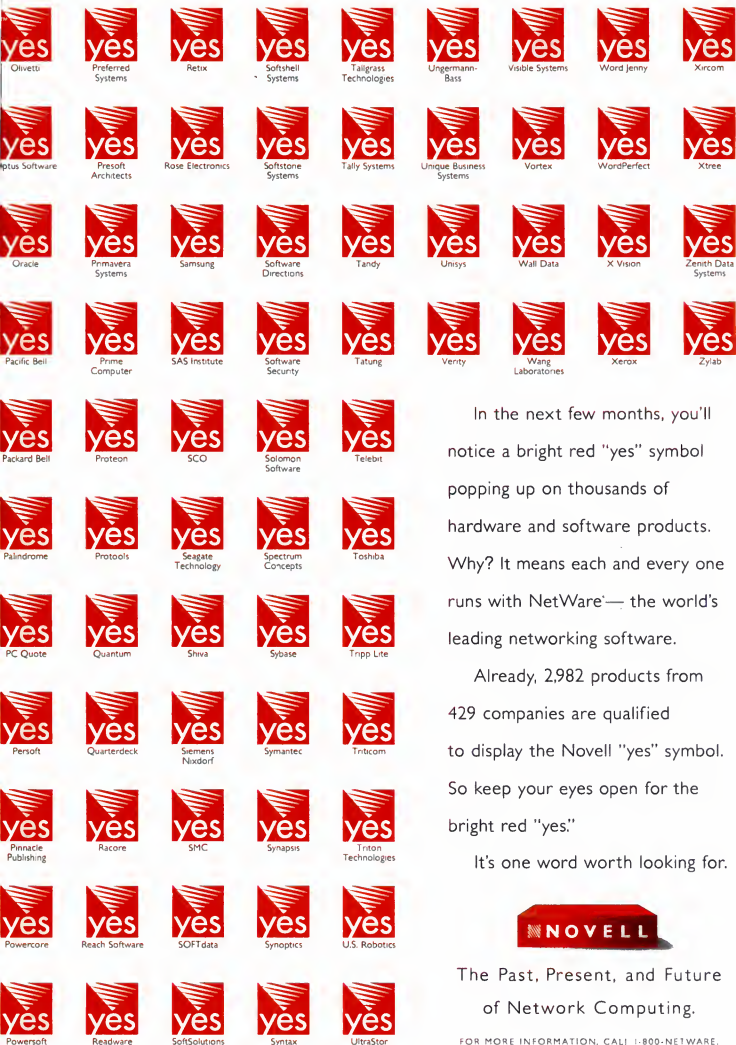
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Letters

THE IMPORTANCE OF UNINSTALLING

Jim Seymour hit the nail on the head in his column "The Uninstall Crunch" (August 1992). Until I heard about the problem with uninstallation, I had every intention of moving to Windows applications.

It is time for publishers of Windows applications to wake up and get serious about including an uninstall feature with every program. There is no question in my mind that the lack of this feature is one of the things that has kept sales of Windows applications from reaching their full marketing potential. Companies that fail to recognize the importance of uninstall programs have their heads in the sand.

Tom Vilov
Pocomoke City, Maryland

Like Jim Seymour, I am frequently frustrated when I need to uninstall software I'm no longer using. I wonder, however, if the idea of being able to press a couple of keys to have all the files belonging to an application deleted is realistic, considering the number of applications that share files.

Sharing files between applications has important benefits. The downside is the problem Seymour raises.

I don't think demanding that software manufacturers provide uninstall routines is the answer. Having software automatically delete files from my disk is a far greater concern to me than installation routines that fiddle with my AUTO-EXEC.BAT or CONFIG.SYS files.

Gordon Padwick
Agoura Hills, California

COSTLY OMISSIONS

As an in-house database application developer, I am leaving the familiar comforts of file-server-based DBMS products behind in favor of SQL-based database servers that are more adequately suited to the task of large-scale, wide-area applications. So far, the process of obtaining and comparing information about the various SQL/server DBMSs has been pure agony, so I was thrilled to see the review of SQL databases ("SQL Databases: High-Powered,



It's time to get serious about including an uninstall feature in every program.

High-Priced" September 15, 1992).

The review was definitely helpful, but I can't ignore some errors of omission in your comparative review.

Most important was the lack of attention paid to price. You selected Sybase as the Editors Choice, but only referred to the \$7,000 annual fee for tech support in the last column of the features table. There is no mention that this is mandatory, or that Sybase charges another 7.5 percent annual maintenance upgrade fee.

Proffering Sybase as the Editors Choice without some qualification with respect to price is like an auto magazine selecting a Lamborghini as "Car of the Year." It's a nice car, but the selection is meaningless to most of us—even if we love to drive.

Jim Hogan
Seattle, Washington

• We have confirmed with Sybase that these additional costs, though mandatory, were not reflected in the comprehensive 16-user price the company originally gave us, which is shown in the features table.—Ed

THE MAN BEHIND THE FONTS

John C. Dvorak's column, "Kiss Your ASCII Goodbye" (September 15, 1992),

touches upon a very important topic. It fails, however, to give credit to the right person and group for beginning the "ambitious project to unify the commonalities of Asian character sets..."

Edwin Smura of Xerox, working under the auspices of the Association for Font Information Interchange (AFII) began the effort and achieved major milestones in getting the right people from each country to work together for three years before getting members of the Unicode Consortium involved.

Mr. Smura's efforts were for the purpose of identifying glyphs that were common among the two Chinas, Japan, and Korea, for the purpose of simplifying and reducing the size of fonts required for support of Asian printing. An important aspect, not mentioned in Dvorak's article, is the practicality of producing and storing fonts that will support a code set of 64 thousand characters.

Alan W. Griffie
Boulder, Colorado

ELECTRONIC LAWYERS CAN'T PASS THE BAR

In the sidebar accompanying the review of various legal software packages, (After Hours, March 17, 1992), *PC Magazine* states that "personal legal software can be used to set up your basic document, which you can then run by your lawyer to make sure it's legally sufficient. Hopefully, your efforts up front will reduce the time spent with an attorney, thereby saving you some of the legal fees painfully associated with consulting your lawyer." Editors at *PC Magazine* should know better.

Would a professional software developer find it easier to review, debug, and modify generic code written by someone else, or to develop a custom application written from scratch? Nothing is harder or more time consuming than going over someone else's work.

Howard M. Helsing
Chicago, Illinois

WRAP IT UP!

I have just read William F. Zachmann's "Beware the Shrink-Wrap Fallacy" (September 15, 1992), and I believe that it

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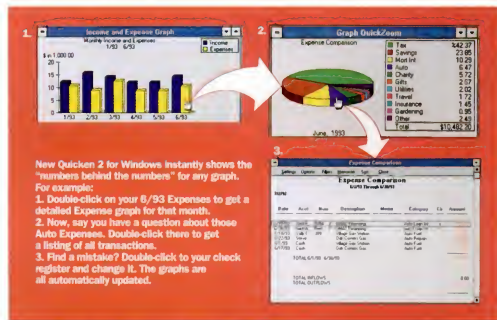
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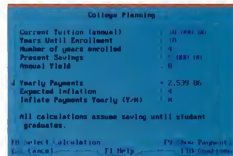
speeds transaction entry dramatically. Just start typing, and if the characters match a transaction you've entered before, the rest of your entry appears as if by magic. You'll never type any transaction twice again!

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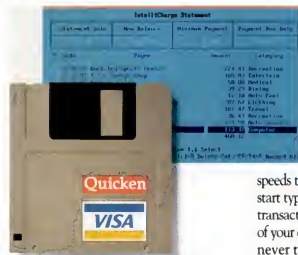
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Bill Crown, DOS Quicken 4 user

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Robert Dinah, DOS Quicken 5 user

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Lanara Abramson, Windows Quicken 1.01 user

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LETTERS

should have been entitled "Beware the Self-Preservation Drivel of an IS Professional." As usual, Mr. Zachmann seems to have missed the point. True, "Shrink-Wrap" choices are not going to meet all the IS needs of an organization. But that doesn't imply that a systems analyst is going to know the needs of the user or an

Learning will never be the same with "books" like Science Adventure. One day as a child reads by computer, a simple click on a word will bring up pictures and explanations.

organization better than the end-user.

Successful systems are systems developed with a high level of user involvement, with strong ownership feelings on the part of the user. It follows that the ultimate goal is the development of systems by users themselves. Downsizing, coupled with the use of middleware tools, is the not-so-distant-future.

*Robert M. Roberge
Toledo, Ohio*

THE FUTURE OF LEARNING IS BRIGHT

I am so excited! I just read your review of Knowledge Adventure's Science Adventure (After Hours, September 15, 1992).

I look forward to the day when children read by computer. Then, for example, when a child wonders why Jules Verne decided to name his fictional submarine "Nautilus," all it would take is a simple point and click on the word to bring up a picture along with a full explanation.

The mind boggles. Learning will never be the same with "books" like Science Adventure.

*Doug Russell
Indian Rocks Beach, Florida*

FREEDOM TO CHOOSE YOUR CURSOR

Congratulations on an excellent article, "The Power Behind Notebook Accessories" (August 1992). However, as publisher of Cursorific 2.0, we feel that the issue of the hard-to-see cursor was glossed over in such a manner as to be misleading to your readers.

The article implies that only the Microsoft Mouse driver makes mouse trails, when it's actually a feature built into Windows 3.1 that works with any cursor enhancement software package. Cursorific 2.0 gives you many more options than the Microsoft driver does; you can change any standard Windows cursor including the arrow, hourglass, I-beam, and Windows resize cursors, and there are many cursors to choose from.

*Bill Detering
Director of Communications
AApex Software
Reno, Nevada*

CONFIG.OLD

My thanks to PC Magazine for the excellent tutorial "Optimizing Your Configuration" (Tutor, June 1992).

I knew my CONFIG.SYS was off, but I didn't know how to get it right. After I finished reading, I knew exactly what to do and why to do it.

*George Wexler
Commack, New York*

A READER OFFERS A SOLUTION

I would like to see you respond to more readers in your Letters column. Often, a reader poses a question that beckons a response, but none is given.

In a letter from Philip P. Brown in your August 1992 issue, he wrote about monitor refresh rates in the 50 to 60 Hz range and problems they cause for people with epilepsy. Mr. Brown should check the specifications of the Super VGA monitors to the VESA refresh standard of 72 Hz. There are many available in the \$350 to \$750 range that should suit his sons needs.

*James Quinn Ross
Albany, New York*

THE CAT'S OUT OF THE BAG

In the September 15, 1992, issue of PC Magazine, I read several letters from readers denouncing OS/2 2.0 and a few praising it. I too would like to praise OS/2

for stimulating Microsoft to release Windows NT. Even in its rough, pre-beta form, Windows NT makes OS/2 look like a plodding dinosaur.

Above all, Windows NT is fast. Even faster than OS/2. It's also simpler to use than OS/2, thanks to the Single Command Shell, the seamless Windows 16-bit support, and the familiar Windows user interface.

Kudos to Microsoft who, despite its many critics, has developed a truly state-of-the-art operating system. Let's hope they ship a production version of Windows NT soon.

*Dave Eriqat
San Francisco, California*

LEAPING LEAP YEARS, PART II

Say it isn't so! Ignore the letter in your September 15, 1992, PC Magazine Letters column because the year 2000 is a leap year. David Bergman is correct in remembering that there are exceptions to leap years always occurring in years divisible by four, but here are the guidelines: Years divisible by 100 are not leap years unless they are divisible by 400. Thus 2000 and 2400 are leap years, but 2100, 2200 and 2300 are not.

*Blaine J. Deal
Concord, California*

CORRECTIONS AND AMPLIFICATIONS

PC Magazine's September 15, 1992, Advisor column incorrectly stated that "A Well Tuned PC: A Guide to Memory Managers" appeared in the same issue. The article can be found in our July 1992 issue.

The toll-free phone number we listed for Microtek (April 14, 1992), was incorrect. The actual number is 800-654-4160.

HOW TO WRITE TO PC MAGAZINE

We welcome your comments and suggestions. Please send your correspondence to Letters, PC Magazine, One Park Ave., New York, NY 10016, or upload it to PC Mag-Net (see page 12 for access information). All letters become the property of PC Magazine and are subject to editing.

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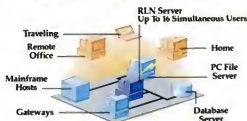
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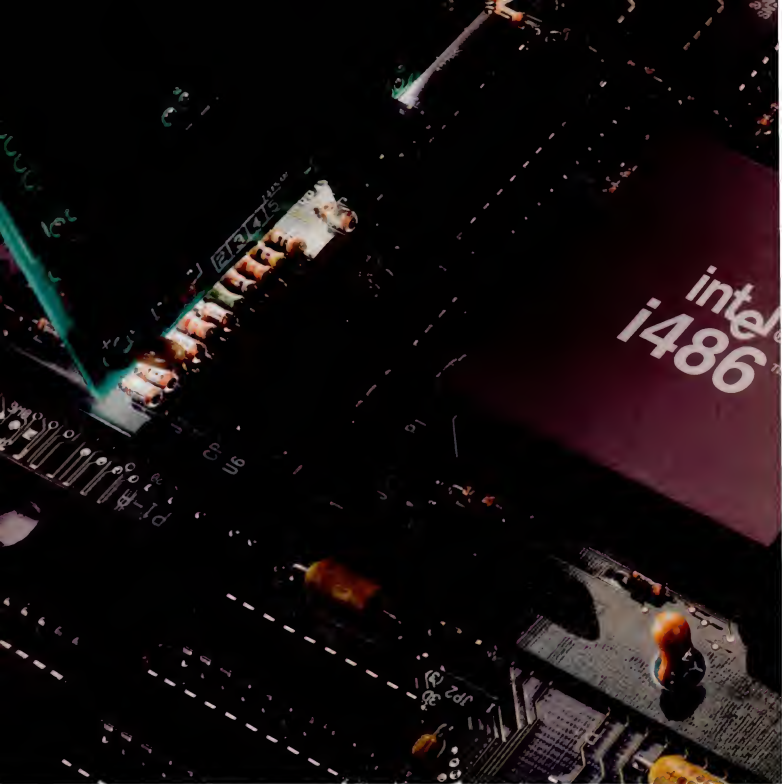
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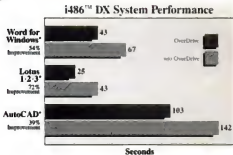
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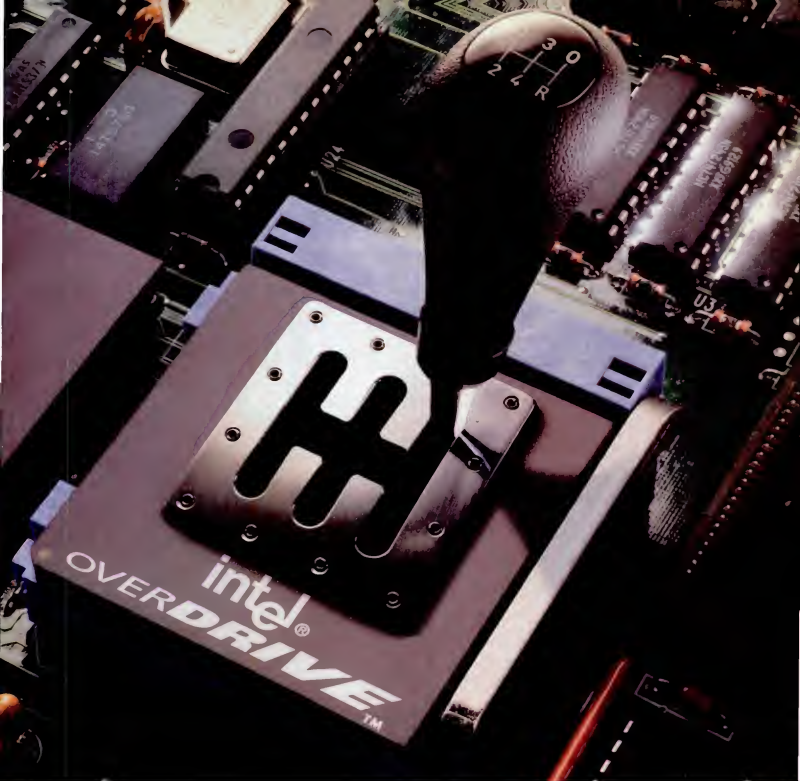
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CIRCLE 265 ON READER SERVICE CARD

Compaq Commits to P5

P5 spawns proprietary bus schemes.

If computer makers want to get the real benefits of Intel's forthcoming P5 CPU, they're going to have to overhaul their systems. At 64 bits, the P5's data path is twice as wide as the 486's, so it will allow twice as much data to be transferred to the memory and I/O subsystems

in each bus cycle. If systems aren't redesigned, the only P5 benefit is a speed (and not a data throughput) boost; rated at more than 100 MIPS, the P5 is twice as fast as the 486 (Trends, September 15, 1992).

Though the P5 chip has been delayed until 1993, it already has its first system convert. Compaq, that company known as a technology leader before founder Rod Canion was shown the door, has retaken its place at the head of the class with a new architecture to handle the P5's bandwidth demands.

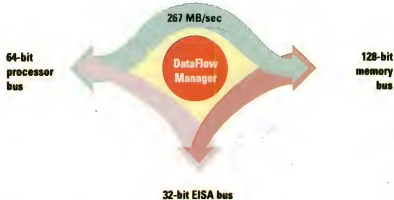
Dubbed TriFlex by Compaq's marketing department, the architecture welds a 64-bit

processor bus and a 128-bit memory bus to a 32-bit EISA I/O bus. The 64-bit processor bus accepts the P5, and the 128-bit memory bus will be required to split transactions and feed instructions to more than one processor. With a Compaq-designed ASIC (called the TriFlex DataFlow Manager) arbitrating, the result should be a system capable of handling the increased throughput the P5 is designed for. The first implementation of the TriFlex will be in Compaq's next-generation Systempro file server, which is due next year.

But Compaq isn't the only system manu-

Continues on page 32

TriFlex System Architecture



Source: Compaq.

The DataFlow Manager allows processor-bus and EISA-bus transactions to occur simultaneously more than 70 percent of the time, claims Compaq.

Sony's Blue Beam

UNLESS YOU'VE BEEN READING the *Daily Yomiuri*, one of Japan's premier newspapers, you may have missed the story about Sony's blue-beam CD-ROM laser, a technology that could triple the capacity on a standard CD.

While traditional red-beam CD techniques are better than ever in terms of access times and data throughput, they still don't hold as much information on a disk as you might like. In fact, not much has changed on the capacity capabilities since Philips and Sony invented audio CD in the late 1970s; the playing time of an audio CD has remained at about 74 minutes. Blue-beam technology should increase playing time to 3 hours 30 minutes. The blue beam has a wavelength significantly shorter than a typical red beam, allowing it to read smaller data structures than are now embedded on CDs. This means more data could be packed onto the disk. Current CD-ROMs hold about 600MB of data; blue-beam CD-ROMs should provide nearly 1.7 gigabytes.

The blue-beam laser experiment was conducted in a Sony laboratory in Japan using a semiconductor layered with laser-making chemicals. The blue beam is generated when an electric current is applied to the semiconductor, which is cooled to -196 degrees Celsius in a liquid nitrogen bath.

You'll turn blue if you hold your breath waiting for any CD-ROM products based on the new technology. They won't show up for five years.—Christopher Barr

Getting Color Under Control

IF TODAY'S PC EQUIPMENT CAN produce millions of colors, why is it so hard to get just one color to appear the same on different devices?

Because colors on a monitor are produced so differently than they are on a printer. The complete solution to color-matching problems hasn't arrived yet, but some proposed fixes are getting warmer.

Color management systems—such as EFI's Eficolor and Kodak Electronic Print-

Pipeline By Gus Venditto

Enter the 486SL

The 386 is getting another kick down the stairs, this time thanks to an acceleration in Intel's schedule for rolling out the 486SL CPU.

The 386 version of the SL was supposed to be the solution to today's limited-capacity batteries, which can't keep backlit VGA screens and small hard disks running for more than 3 hours.

Now that the 486SL chip is about to become widely available, the cutting edge for laptops will soon become 33-MHz 486SLs that should last about a full day. (That assumes you're not pounding the keys and crunching numbers every minute but are taking regular breaks for ringing phones and visiting colleagues. For an intense work session, as on a transcontinental flight, you'll probably squeeze out only 4 hours.)

Part of the 486SL's longer life will come from its lower power draw, since it's a 3.3-volt chip (Pipeline, "Low-Voltage Systems: From the Laptop to the Desktop," September 15, 1992). And it's likely to be the processor that brings the laptop into the 3.3-volt era.

The 386SL chip is being overshadowed by the 486 in laptops, but it may give life to a new category that's shown only weak signs of life: the handbook. The Gateway's 2000 HandBook is the first entry in the genre. With only a Chips & Technologies 286 clone for a processor and a 4-hour battery life, the HandBook has some limitations. But it weighs less than 3 pounds, and that's a breakthrough for a system with a full-size keyboard and a hard disk.

Next year at this time there will be a wide range of 2- to 3-pound portables powered by 386SL chips.

Predicting that is easy. Knowing what to call them will be tough; Gateway's already trademarked the HandBook name.

Gus Venditto is editor of PC Sources and a contributing editor to PC Magazine.



PHOTOGRAPH BY PETER GREGG

ing System's Precision Color Management System—operate by taking RGB (red, green, blue) data from your monitor and converting it to CMYK (cyan, magenta, yellow, black), which your printer uses. They work by using a device-independent color system as a reference when translating colors among devices. Eficolor and PCMS both use the CIE XYZ color model, a mathematical map of all visible colors that assigns a value to each color and was developed by the Commission Internationale d'Eclairage (CIE) in 1931. (PostScript Level 2 also uses CIE XYZ as a reference for producing color output.)

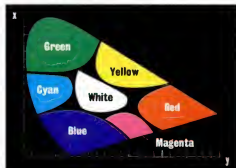
Eficolor and PCMS both started in the Mac arena and will move to the PC by mid-1993. The Eficolor technology will appear as a menu item in QuarkXPress 3.2, and a library of Eficolor profiles (the translation files for specific devices) will be available as an independent package.

Device-independent color is not the total solution, however. Each device is still limited by its *color gamut*—the range of colors that it can produce. Tektronix, known for its high-end line of color printers, has one way

around the gamut overlap problem: TekColor. The TekColor Picker (for the Macintosh) displays the gamuts of your monitor and printer and lets you select colors that can be produced by both. Led by NEC Technologies and Mitsubishi Electronics America, several monitor companies have models that allow users to adjust the red, green, and blue intensities.

Perhaps the best way to coordinate color on all devices is to have a maestro on the system-level level, much like Apple's proposed

CIE XYZ Color Model



The CIE XYZ color model provides a mathematical map of all visible colors.

System 7 color management. For PC users, the problem may not be completely resolved until Microsoft tackles it in Windows. Microsoft says that future versions of Windows will include color management, probably based on the CIE XYZ model or something similar. As to timing, the company would only reveal that this type of color system will be unveiled at some point following the introduction of Windows NT, which is due early next year.

—Catherine Kunkemueller

Fax OCR Gets Better and Faster

TODAY'S OCR PACKAGES DO A decent job recognizing faxes sent in fine mode and converting them to editable text, but they choke on faxes sent in the faster, more efficient standard mode. Soon, sophisticated neural network technology will let you receive and convert faxes in standard mode without sacrificing accuracy.

Products such as Calera Recognition Systems' FAXGrabber (which provides the engine in Intel's new Faxability Plus/OCR) have gone a long way toward providing PC fax board users with the ability to translate received bitmapped images accurately into text. But they are stymied by their reliance on fine mode, which is slow in transmission. Standard mode, which is faster, is also tougher to read because every other line is skipped, leaving the fax software to handle distorted images.

Caere Corp.'s new product, FaxMaster, claims to read bitmapped images sent in standard mode without sacrificing accuracy, because of its new AnyFax OCR technology. AnyFax can intelligently interpret information lost during low-resolution transmissions by recognizing characters based on weighted probabilities. Larry Miller, Caere's vice president of marketing, says that AnyFax does this with a neural net technology that looks for significant features (horizontal, vertical, or curved lines) within the altered characters. Once a feature is spotted, the number of possible letters with that particular characteristic is narrowed until another significant feature is found to determine the identity of the character.

Other vendors are sure to follow suit. According to Dan Meub, Calera's vice president of marketing, Calera will release an OCR fax board by the beginning of 1993 that will maintain high levels of accuracy while receiving faxes in standard mode.

—Tim Albano

Programming Without Words

YOU MAY NO LONGER NEED YEARS of study and a deep knowledge of computers' inner workings to develop custom programs. Visually oriented, mouse-driven development systems are making the esoteric world of programming accessible to the masses, and innovators at small companies are leading the way.

General-purpose Visual Development Environments (VDEs) such as Microsoft Visual Basic, which lets you draw the user interface with a mouse and then add programming code to control what each component does, are fairly commonplace now

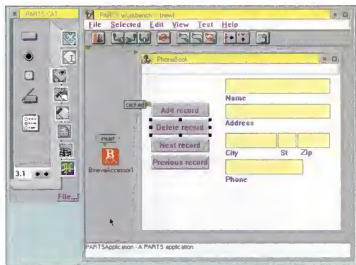
("The Visual Development Environment: More than Just a Pretty Face?," June 16, 1992). There are also some special-purpose database development systems that let you develop entire database applications without coding. For example, MicroSTEP, from Syscorp International, offers a DOS-hosted VDE for database applications. Borland's Windows-hosted ObjectVision uses a flowchart metaphor in conjunction with spreadsheet-style @-functions. But two new products about to appear on the market go a step farther.

Parts, from Digitalt, and Series Programmer, from Series Corp., are general-purpose visual development systems for the PC platform that will be released by year's end. Though their underlying designs are different, both Parts and Series Programmer rely on object-oriented technology to provide reusable code modules that are accessible as icons. Modules are customized through menus and then connected by lines that describe the interaction between them. Both of these products give developers the option of using a programming language, but no coding is necessary to develop sophisticated programs such as e-mail systems or custom database applications.

Parts, with a planned retail price of \$1,995, is written in SmallTalk for OS/2 2.0. A 16-bit version was released to a limited number of customers on September 1; the 32-bit general availability release is expected by December. Digitalt plans to release a Windows version of Parts during the second half of 1993. Parts uses a hierarchical scheme, with over 60 prewritten parts. The "visual parts" include interface objects such as horizontal and vertical sliders, push buttons, and menus. The "nonvisual parts" include access to disks, files, DLLs, external programs, printers, and DDE support. Compound parts can be made from these basic parts, added to the Parts Workbench as icons, and reused. New parts can also be written in a standard programming language.

Series Programmer, which is written in C++, was first released for the Macintosh platform in August 1989. The Windows version is in beta testing and is expected to be released in October. Series Programmer will

retail for about \$400. A version that includes a language option, Series Developer, will retail for about \$600. Series Programmer categorizes components as either "nouns" or "verbs." Nouns include objects such as databases or networks. Verbs are functions that act on nouns; for example, the Send Mes-



Digitalt's Parts provides over 60 prewritten parts, including such visual parts as horizontal and vertical sliders, push buttons, and menus.

sage verb acts on network objects, and an Add Record verb acts on database objects. The Macintosh version of Series Programmer includes 55 nouns and over 400 verbs; the initial PC release will contain 30 nouns and about 200 verbs, with more to come in a subsequent upgrade.

—Sheryl Canter

Rough and Tough

BAGGAGE HANDLERS, CLUMSY users, and even nature itself can be the downfall of a portable computer, causing anything from minor data loss to complete system failure. But technological improvements in plastics, hard disk design, and electronic storage are making today's portable PCs more rugged and reliable than machines built only two or three years ago.

NCR designed its System 3170 portable computers with molded ridges along the sides for better shock distribution, according to marketing manager Nicole Kelly. NCR considered using stronger plastic in the case as well, but found it would add weight.

According to Dell Computer Corp.'s John Biebelhausen, manager of portable systems, Dell runs its notebook computers through a series of trials that includes drop tests onto a steel floor. "We raise the drop height until we see damage," he said, "and we run the tests until the machines are de-

Top Retail Software

Current ranking	Last issue	Product/Company
1	3	QEMM-386 6.0 Quarterdeck Office Systems
2	10	Excel for Windows 4.0 Upgrade Microsoft Corp.
3	5	WordPerfect 5.1 for DOS WordPerfect Corp.
4	1	Microsoft Windows 3.1 Upgrade Microsoft Corp.
5	2	Microsoft DOS 5.0 Upgrade Kit Microsoft Corp.
6	4	Microsoft Windows 3.1 Microsoft Corp.
7	11	Word for Windows 2.0 Microsoft Corp.
8	13	WordPerfect 5.1 for Windows WordPerfect Corp.
9	12	Procomm Plus 2.1 Datastorm Technologies
10	—	WordPerfect Windows Trade Up WordPerfect Corp.
11	—	WordPerfect Additional License WordPerfect Corp.
12	9	Stacker 2.0 Stac Electronics
13	14	Word for Windows 2.0 Upgrade Microsoft Corp.
14	—	The Norton Utilities 6.01 Symantec Corp.
15	—	Quicken 5.0 Intuit

The list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending June 6, 1992. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and cannot be interpreted as a picture of the entire software market. Sales information compiled by Ingram-Micro.

stroyed." Dell's tests confirmed what unlucky users already know: The hard disk is usually the first thing to fail. Drive and computer manufacturers try to protect the fragile units, usually with a shock-absorbing cage and rubber mounts, but if the sensitive head ever contacts the spinning platters, the result can be data loss or a complete hard disk crash.

Hard disk manufacturers are continually exploring ways to make hard disk drives more reliable during sudden shocks. For example, Hewlett-Packard's 1.3-inch Kittyhawk hard disk, introduced last summer, momentarily cuts power to the disk in the event of a shock. Expect to see new technology introduced by other vendors at Fall Comdex in November that will make the units more shock-aware, if not actually shock-resistant.

Another way to protect the data on a portable computer is to eliminate the hard disk completely and replace it with flash memory, currently produced by AT&T, Intel, and SunDisk. Unlike conventional DRAM or SRAM chips, flash memory modules retain their information even after power has been turned off (Trends, June 30, 1992). With virtually jolt-proof solid-state technology, flash memory may someday be an alternative to

magnetic media, though its cost is high (30 dollars per megabyte to system vendors, according to Intel).

Hard disks aren't the only part of a portable computer in danger of breakage from a fall. The display—which is basically two sheets of millimeter-thick glass with a liquid crystal filling—can shatter easily, according to Dell's Biebelhausen. "There's been speculation about replacing glass with plas-



Don't try this at home—at least not with today's notebooks!

tic, but right now you can't get the optical characteristics you need with a millimeter of clear plastic. They have to come up with new materials," he explains. Eventually, with high-tech composite cases, flash memory, and a plastic LCD, says Biebelhausen, "You could jump on the machine and it wouldn't break." —Andrew Kantor

Briefs

"YOU'LL BE ABLE TO CALL UP AND order any parts you want," says Bob Corrigan, president of the new IBM Personal Computer Co., about the build-to-order program that should be in place by early next year. Taking (custom) phone orders isn't the only new ground being broken by the Big Blue spin-off. Product development cycles are shorter than ever before. According to Corrigan, the recently introduced PS/1 lines (Essential, Expert, and Consultant) were designed and delivered in six months. In the past, IBM boasted when it got the process down to one year.

IT MAY TAKE A WHILE BEFORE OPTICAL disks replace hard disks, but they seem destined to replace microfiche. According to Dave Kalstrom, executive vice president of optical drive maker Plasmon Data Systems, one \$145 optical

disk holds as much data as \$8,000 worth of microfiche. No wonder the Archivo General de Indias in Seville, Spain, chose Plasmon's optical drives for its massive archival project, which includes millions of pages of maps, documents, and artwork relating to Christopher Columbus and the Spanish discovery of the New World.

SOFTWARE COMPANIES MAY NOT ABANDON

list prices as quickly as their hardware counterparts (Trends, October 13, 1992), but at least one software house is starting life without suggested retail prices. Axis Software, founded by Micrografix CEO Paul Grayson and Stephen Buerkle, is introducing its Zagat-Axis CityGuides with an "approximate end user price" of less than \$100 for a single-city guide, \$250 for Chicago, Los Angeles, and New York. But don't look for the same at Micrografix: "It's easier for a new company," says Grayson. —Mary Kathleen Flynn

CD Confusion

THE MULTIMEDIA PC LOGO PROMISED to make it easy to identify software that would run on your multimedia machine. But now, several incompatible CD-ROM formats, each with its own logo, are confronting consumers, making multimedia shopping anything but simple.

The latest logo is MMCD, which identifies software that will run on the Sony Multimedia CD-ROM Player. Although some of your MPC disks might actually boot on the machine, most won't. One reason is that the player uses the CD-ROM XA (extended architecture) format, which Sony developed with Philips and Microsoft but which is not included in the MPC spec—despite Microsoft's leadership role in the MPC Council. Sony advises MPC owners to buy an XA upgrade board. But IBM, which declined to join the MPC Council but is selling MMCD apps, sure looks smart for supporting XA in its Ultimedia PCs.

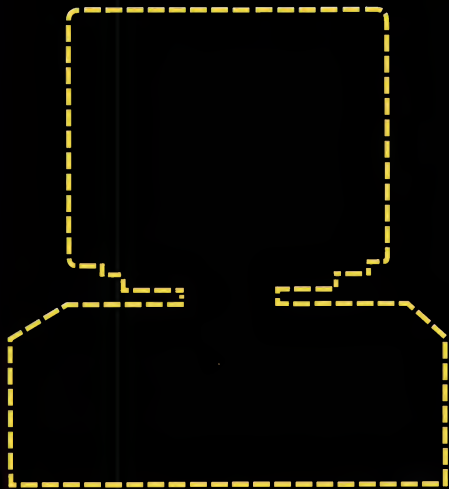
Microsoft and Compton's NewMedia are selling development tools for disks to run on more than one platform. But even Microsoft doesn't believe that all disks will run on all machines. Microsoft vp Rob Glaser sees three separate sets of apps emerging: desktop (for MPC machines), TV (for Tandy's Video Information System, which includes Modular Windows), and personal (for the Sony Multimedia CD-ROM Player). Woe to the unlucky consumer who can't keep the logos straight. —Mary Kathleen Flynn

Compaq's TriFlex

CONTINUED FROM PAGE 29
facturer making 64-bit plans for the P5. AST Research maintains that its systems won't require a massive overhaul and that its Manhattan-series file servers are designed to accept the P5. The Manhattans are multiprocessor servers with proprietary 64-bit slots that can easily handle the P5 as an upgrade.

IBM also believes in upgradability and intends to use the P5 not just in servers but across its entire product line. Expect to see the P5 in IBM's Micro Channel-bus PS/2 Server 295, as well as the Model 95, before it's used in lower-end systems. The Server 295 is a multiprocessor computer, and while IBM wouldn't elaborate on which architectural enhancements it would add to accommodate the P5, it was confirmed that the Server 295 would require only modest changes in the I/O and memory subsystems. —Christopher Barr

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And don't forget, when you purchase any new ZEOS Windows based system, you will also receive your choice of two: *Lotus 1-2-3 for Windows*, *Ami Pro*, and *Freelance Graphics*. You're going to love it. The software alone carries a suggested retail price of over \$1,000 and we're giving it to you *absolutely free*. Now that's ZEOS Value.

24-HOUR-A-DAY SUPPORT. AND MORE!

Remember too, ZEOS provides you with our top-rated 24-Hour-a-Day Toll-Free Technical Support. *Plus* your new ZEOS system is covered by our 30-Day Money-Back Guarantee, One Full Year Limited Warranty, and our Express Parts Replacement Policy.

MORE FEATURES. MORE PERFORMANCE. LOWER PRICES.

There is no question. While everyone else is cutting prices by giving you less, ZEOS is cutting prices and giving you more. Whether you choose the 486SX-25, the amazing 486DX2-66 or anything in between—ZEOS gives you the *most for your money*. So go ahead and give us a call.

CALL NOW TOLL FREE.

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Ordering your new ZEOS upgradable system is easy. Simply pick up the phone and give us a call. A friendly and knowledgeable ZEOS Systems Consultant is ready to answer any questions you may have. You're going to love your new ZEOS system. *Why not give us a call right now!*

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Performance.

the board your new ZEOS system supports both SCSI I and SCSI II type devices. You can now have SCSI hard drives (running in *addition* to your standard IDE drives) plus tape backups, optical drives and a host of other SCSI peripherals. Take it now or add it later. Only from ZEOS.

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Of course power and expandability are ZEOS hallmarks. In their haste to cut features and to cut prices it would seem the others have forgotten about your future. That's why ZEOS has things like *eight* expansion slots, *high-capacity* power supplies and *seven* drive bays all in our standard SpaceSaver desktop cases. We care about you and the long-term ownership of your new computer. We invite comparison. The more you look, the more obvious your ZEOS advantages become.

Like the two cooling fans you'll find in every ZEOS system. While ZEOS systems run cooler than most with *one* fan we still give you *two whisper-quiet cooling fans*. The cooler your system runs the longer it will last. We also include

ZEOS systems feature award winning reliability and support.
Nine times PC Magazine's Editors' Choice.



The on board SCSI option lets you add SCSI I or II devices anytime. SCSI hard drives, opticals and more are easy to add.



Eight expansion slots provide you with plenty of room to add to your system in the future.

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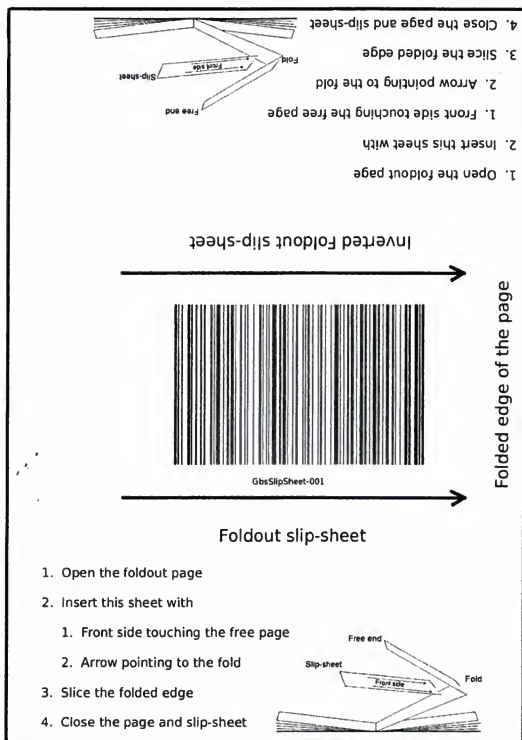
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Consider the Vertical Option. We can build your new upgradable system in our eight-bay vertical case. It comes complete with our high capacity power supply and two cooling fans. Add only \$95.

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1. Follow instructions on the other side

Inverted Back



Gbs58p6ack-0018

Back

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What does this mean to you?

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Circle 151 on reader service card.

A. YOUR PERSONAL INFORMATION

Please complete all appropriate sections, providing at least two years residence and employment history. THIS IS NOT A CREDIT AGREEMENT! One will be sent to you upon authorization of an account. (This form must be used to process your application.) All financed purchases are subject to credit approval. If you have any credit questions, please call 800-421-8942 for assistance. Thank you!

Name _____ Previous Address _____
Home Phone (____) _____ City _____ State _____ Zip _____
Soc. Sec. No. _____ Date of Birth ____/____/____ Employer _____ Since? (Mo./Yr.) _____
Address _____ Apt. _____ Monthly Gross Salary \$ _____ Daytime Bus. Phone (____) _____
City _____ State _____ Zip _____ Previous Employer _____ From _____ To _____
Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____ Occupation _____

A married person may apply for individual credit. I am applying for (please check appropriate box):

☐ **JOINT CREDIT** with another person. Complete entire application.

☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.

☐ **INDIVIDUAL CREDIT**. Do not complete section C.**

** If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

NOTICE TO WISCONSIN APPLICANTS:
YOU MUST DISCLOSE YOUR MARITAL STATUS.

☐ married ☐ unmarried ☐ legally separated

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation.

Additional Monthly Income \$ _____ Source: _____

Name & Address of Nearest Relative Not Living With You _____

Relationship _____

B. CREDIT INFORMATION

PLEASE TELL US IF YOU HAVE A:

Checking Account ☐ Yes ☐ No
Savings Account ☐ Yes ☐ No

Y/N How Many?

Y/N How Many?

Bank Loan _____ Dept Store Charge Card _____

VISA _____ Credit Union Account _____

MasterCard _____ Other Major Charge Cards _____

Finance Company Loan _____

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Home Phone (____) _____ Date of Residence (Mo./Yr.) _____

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

Bus. Phone (____) _____ Monthly Gross Salary \$ _____

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I authorize ZEOS International, Ltd. or its assignees to investigate credit records and to report my performance hereunder to credit agencies. I hereby certify that the following information is furnished to you for the purpose of obtaining credit and is true and correct to the best of my knowledge and belief.

Applicant's Signature _____ Date _____

Joint Applicant's Signature _____ Date _____

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NY-A consumer credit report may be requested in connection with this application or in connection with updates, renewals or extensions of any credit granted as a result of this application. If I subsequently ask for this information, I will be informed whether or not such a report was requested and, if so, the name and address of the agency that furnished the report.

OH-The Ohio laws against discrimination require that all creditors make credit equally available to all creditworthy customers and that credit reporting agencies maintain separate credit histories on each individual upon request. The Ohio Civil Rights Commission administers compliance with this law.

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ZCDJT-PCM-921110

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You can apply for your very own Z-Card and low, low monthly payments right now. Simply fill out this application and fax it to 612-633-7507. Or mail it to ZEOS International, Z-Card Processing Center, 530 5th Ave. NW, St. Paul, MN 55112. We'll contact you as soon as your credit line is established, usually within 24 hours of receipt. Apply today!

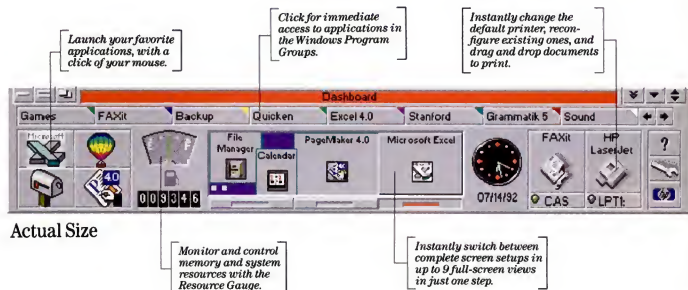


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CIRCLE 026 ON READER SERVICE CARD

First Looks

HANDS-ON EVALUATIONS OF THE NEWEST SHIPPING PRODUCTS

■ Personal Finance

Quicken 6.0 Adds Electronic Credit Card Statements

BY BILL HOWARD

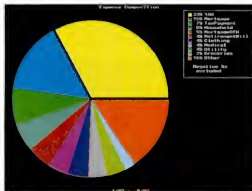
After eight years and five previous versions, you'd think Intuit

would have run out of enhancements to add to Quicken, its best-selling \$69.95 personal finance program. Not so. In fact, Intuit lists more than 100 new features for Version 6.0. In truth, that works out to about a dozen significant enhancements, but there's no doubt that Quicken keeps getting better.

Quicken for Windows 2.0, also \$69.95, was to follow DOS Quicken 6.0 by a month, shipping in early October. The programs will use the same data file format and will be closely matched on features.

Quicken 6.0's most publicized new feature is Intelli-

Charge, a no-fee regular or gold VISA card option that reports back to Quicken each month's credit card charges, categorized,



EXPENSE GRAPH: Where your money goes.

on-disk, or by modem. You still get the usual monthly paper statement.

The categorization is gener-

ally quite accurate. If you already have a category listed for a merchant because you write paper checks as well, Quicken uses that; otherwise it uses a standard code the merchant provides to VISA. The few glitches encountered in five months of testing IntelliCharge were mostly minor. Charges at a local liquor store were reported back as "legal & professional fees." (Intuit suggested the merchant may have inadvertently misreported his business classification to VISA.) A VISA application comes in each box.

The card is issued through Primerica Bank and carries a rate of 8.75 percentage points over prime, or about 15 percent (currently). While the card is free, the optional monthly state-

ments cost \$3, delivered via modem, or \$4.50 on-disk. To entice you, the first six months are free. The card doesn't offer frequent-flyer bonus mileage points. Intuit said most credit card users don't generate enough charges for airline miles to make a difference. It takes \$20,000 to \$30,000 worth of purchases to earn one free round-trip domestic ticket, or five to ten years of charges for the average credit card user. However, because banks' best customers are the ones who charge the most, Intuit says it's pursuing a future airline tie-in.

Quicken's other major new feature is the ability to produce summary graphs of your income, expenses, and budget. The charts aren't much more sophisticated than Lotus's 1-2-3 graphs of a decade ago, but they're quite handy and only a few keystrokes away. You can generate 35 chart types.

One of the new features, called QuickFill, automatically

• *Continues on page 40*

■ Portable PCs

Toshiba Joins Low Price Fray With Three New Notebooks

BY CHRISTOPHER BARR

Toshiba's new Satellite series of portable systems boldly goes where no Toshiba notebooks have gone before: into the burgeoning value-priced market. The three notebooks, which start at \$1,799 for the basic T1850 and range up to \$3,299 for the color T1850C, will vie for shelf space and mind share against low-cost rivals such as Compaq's \$1,699 Contura and Dell's wide-ranging Dimension series.

Though the systems feature

a new, more rounded case design, the three notebooks in the Satellite Series are a small step rather than a giant leap in new technology. Toshiba is staying with tried-and-true 386SX processors rather than going with the 386SL or 486 processors used in its higher-end 3300SL and 4400SX notebooks. The color T1850C has a passive-matrix LCD panel instead of a more expensive active-matrix TFT (thin-film transistor) display, and the batteries are nickel cadmium, not nickel hydride.

But who can argue with the



NEW SHAPE: The \$3,299 T1850C.

notion of buying an affordable Toshiba? The \$1,799 T1850 is built around a 20-MHz 386SX with a 60MB Corner hard disk and 2MB of RAM, expandable to 10MB. It weighs 6.8 pounds, is of average size (though a little taller and heavier than the Contura), and doesn't present the kind of options that many

• *Continues on page 42*

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■ Windows Utilities

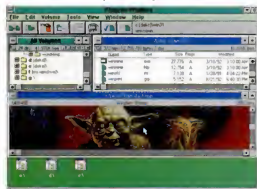
XTree for Windows: Popular File Manager Gets GUI

BY BARRY SIMON

XTree Gold users who switched to Microsoft Windows have been waiting patiently for this popular file manager to make the switch too. The wait is over. XTree for Windows (\$99) is one slick utility.

Multiple directory/tree windows, drag-and-drop, destination pointing, and a natural approach to manipulating files compressed with PKZIP are among the features that make this product special. It also includes a program called XTree Link, which is similar to LapLink and to the transfer program included with some OEM versions of DOS 5.0.

The central object that gives



FILE WISDOM: XTree for Windows gives you three views of your files.

you more control than any other file manager is the tree window. As in other programs, you can set up the window to display a single drive, but XTree also gives you the ability to display all drives, all local drives, any subset of drives, or even a single branch of a tree.

Associated with each tree window is a directory window that you can set to change the display as you move along through the tree. You can also open a directory or a combined directory window that can show

several directories all at the same time.

XTree for Windows lets you copy or move files or whole tree branches by dragging and dropping them on the destination in either a tree or directory window. You can also select the files and click on the button bar to bring up a dialog. Here, you type in the destination dialog or use the mouse to point to the destination in a tree or directory window.

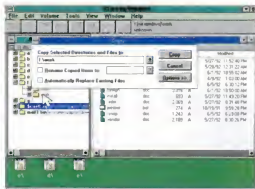
The program offers two selection methods: the standard Windows method where a mistaken left click will remove a selection you so laboriously made, and a method unique to XTree that marks files with a check mark. Once a file is marked, it remains marked until you explicitly unmark it. There should be a mouse shortcut for marking so that you don't have to go to the menus or use the awkward Shift-M accelerator key-stroke.

You can select multiple files for dragging and dropping to new locations as well as for launching. For example, select a group of Word for Windows files, hit Enter, and you'll load all the files into WinWord at once.

Experienced XTree Gold users may be disappointed by one design decision. Among the great attractions of XTree are the single-keystroke commands, such as "C" for copy. While there are still some Ctrl-key shortcuts (for example, Ctrl-C for copy), there are fewer of them than in XTree Gold, and they all use the Ctrl-key.

NEW FILE VIEWERS

XTree for Windows comes with a wide array of file viewers: over 30 word processor formats, the three leading spreadsheet formats, dBASE and Paradox for-



COPY QUICK: To copy a file, you can pick the destination by pointing to it.

mat, and 13 graphics viewers. The .PCX and TIFF viewers failed on 24-bit color files. In informal testing, the viewers were slower than those in The Norton Desktop for Windows by about 30 percent.

XTree for Windows handles compressed files in the .ZIP format especially well. It uses a metaphor that treats individual .ZIP files as disk drives. They can be "mounted" in a tree window, and once there, you add to the .ZIP file or extract from it simply by dragging and dropping as if you were copying files. Moving (copy, followed by deletion) doesn't work when the target is a .ZIP file.

A little-known property of the .ZIP format is its support for subdirectories inside a .ZIP file. XTree for Windows' implementation will make this feature more popular.

You can now copy a whole directory structure into a .ZIP file for archiving purposes. One special feature of the ZIP handling is that the viewers work inside .ZIP files, even recursively for ZIPs within ZIPs. No file manager other than Lotus's Magellan has ever done this.

Although XTree for Windows is a pleasure to use, it has some bothersome drawbacks. At the top of the list is its inability to go directly to the first file or directory that begins

with a given letter. Windows' File Manager lets you hit "S", for instance, and go directly to the first file that begins with "S." An even better approach, which The Norton Desktop for Windows implements, lets you type in several letters of the filename.

Other odd limitations: You can save the current configuration of open files and directories, but you can't save multiple configurations. And although you can search for text within a file, you can't search within a group of files.

XTree Co. has produced a Windows file manager that may give it the market dominance it

already enjoys on the DOS side. The only serious competition is Windows File Manager (which is good enough for many users) and The Norton Desktop for Windows.

• **List price:** XTree for Windows, \$99; upgrade, \$39.95. Requires: 2MB RAM, 2.2MB hard disk space, Microsoft Windows 3.0 or later. XTree Co., 4115 Broad St., Bldg. I, San Luis Obispo, CA 93401; 800-395-8733, 805-541-0604; fax, 805-541-4762.

Circle 423 on reader service card



From October 26 through October 30, you can go on-line to discuss XTree for Windows with Barry Simon and XTree Product Manager Chris Williams. Type GO ZNT:EXEC from any CompuServe prompt.

■ Databases

Paradox 4.0: Snappy Speed and Interface

BY SAL RICCIARDI

With Borland International's release of Paradox, Version 4.0 (\$795), nearly all aspects of the popular database manager have undergone an overhaul. While there are still some shortcomings, the new version is more modern and approachable for end users and more capable for developers.

The most obvious enhancement is Paradox's new interface, which is similar to Borland's DOS-based language products and to Quattro Pro. You can now place multiple, resizable, overlapping windows on the desktop and manipulate them using the mouse or keyboard. The old Lotus-style menu system has been replaced by pull-down menus and dialog boxes.

Paradox now supports extended video modes such as those provided by Personics Ultravision, letting you use 132-column screen modes if your system can handle that. If you'd

prefer the old-style Paradox interface, a menu option and a PAL command will let you switch back. While the interface is more attractive, Borland missed an opportunity to make some obvious improvements. For example, when opening a table or script, you still cannot traverse your directory tree to look for the required file.

The report and form designers have not yet been upgraded to support the mouse; while your design will appear in a movable window, you cannot click and drag fields the way you might expect, and the forms designer does not support any of the new controls you can use in dialog boxes. One improvement to the report designer is a report preview that lets you route report output to an on-screen window.

Borland's engineers have made several changes to im-

prove performance. All scripts are now precompiled into .SC2 files before they are executed, making interpretation faster. Caching and network algorithms are improved, and Paradox now maintains only one .LCK file per directory on a network, so it now makes fewer calls to DOS to open and close .LCK files, which saves time.

Paradox 4.0 supports multiple memo fields—variable-length text fields up to 256MB, and lets you view or edit memos using the built-in editor. Also included is support for a binary

index. Other PAL improvements include language support for traversing a table in secondary index order, support for the new memo field types, and support for low-level binary file I/O.

The improved script editor now supports basic operations such as cut-and-paste and search-and-replace. You can still tell Paradox to call your favorite external script editor. On the downside, PAL still lacks a professional-quality debugger.

Paradox now uses a DPML-compliant memory manager instead of the VCP1-compatible version in the prior release. This lets you run Paradox 4.0, now a protected mode application, within Microsoft Windows in 386 Enhanced mode.

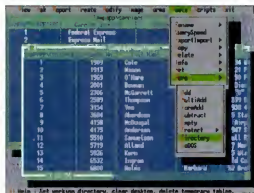
Multiuser application developers will appreciate changes made to Paradox's query restart mechanism. Designed to ensure the integrity of queries and reports, it detects any change that would effect the results of a query-in-progress, and forces the query to start over.

Paradox 4.0 is backwards-compatible with Version 3.5, so your PAL applications should run with little alteration. However, Paradox 4.0 does not share the same level of compatibility with the upcoming Paradox for Windows ("Still To Come From Borland: Paradox and dBASE for Windows," March 31, 1992), a completely new product that uses a new language called Object-PAL. Porting applications to Paradox for Windows will require some effort.

Paradox 4.0 is a substantial improvement over 3.5, even if it seems unfinished. Paradox users would be wise to upgrade.

•List price: Paradox, Version 4.0, \$795, upgrade \$199.95. Requires: 1MB RAM, 5MB hard disk space, DOS 3.1 or later. Borland International Inc., P.O. Box 660001, 1800 Green Hills Rd., Scotts Valley, CA 95066; 800-331-0877, 408-438-8400.

Circle 428 on reader service card



NEW LOOK: Paradox 4.0, a new user interface, supports multiple, resizable windows.

large object field that lets you store any type of binary data such as graphics images or even executable files. To manipulate this data within Paradox, you must supply your own memo field editor, which can be hooked into Paradox.

IMPROVED PAL

The Paradox Application Language (PAL) has been enhanced with new commands to support the new user interface. You can create and manipulate windows and pull-down menus, and you can watch for, trap, and respond to mouse or keyboard events. You can also create dialog boxes that include pick lists, push buttons, radio buttons, check boxes, text edit fields, and slider controls.

There's a new type of array called a dynamic array. Instead of declaring a specific size, you grow and shrink it as needed, and you address its elements using a text string called a tag instead of the traditional numeric

Benchmark Tests: Paradox 4.0

Though none of our tests substantiate Borland's claim that Paradox 4.0 is ten times as fast as Paradox 3.5, significant performance gains are evident in loading, sorting, and indexing databases. Results for the top-performing FoxPro 2.0 are included for comparison.

These single-user tests were performed on a Compaq Deskpro 386/25M with 8MB RAM, a 340MB hard disk, and Compaq DOS 5.0. Though not composed of a typical mix of everyday database operations, the tests do accurately predict overall performance.

Minutes:seconds	Load	Index	Sort
10,000 - record file			
Paradox 3.5	03:13	01:02	00:24
Paradox 4.0	02:28	00:23	00:06
FoxPro 2.0	00:25	00:07	00:23
100,000 - record file			
Paradox 3.5	28:32	19:54	09:31
Paradox 4.0	22:20	02:43	02:32
FoxPro 2.0	02:59	01:33	06:08

Lower scores represent better performance

First Looks

Quicken

CONTINUED FROM PAGE 37

completes transactions once you type in the first few letters of the payee's name; type "AM" and QuickFill offers to enter your monthly American Express payment. There's also a pop-up monthly calendar.

When viewing your checkbook register, you can toggle between two-line and single-line views, allowing you to see 18 transactions per screen instead of 6. The rudimentary Quicken loan payments calculator, which automatically apportioned varying principal and interest amounts in each month's check in Version 5.0, now allows you to include a fixed impound amount as well, for real estate taxes.

If you're using the CheckFree electronic payment option, you can now enter fixed monthly payments (such as the cable TV bill) once, and they'll be made automatically. With Version 6.0, you can also send and receive electronic mail from CheckFree if you have a question about a payment.

In a bid to become more of an all-purpose financial tool, Quicken has added five what-if

financial calculators: loan, investment, retirement, college, and mortgage refinancing. Quicken's existing portfolio management is strengthened with the ability to download historical stock prices via the Prodigy on-line service.

THE BEST GETS BETTER

Quicken works like a paper checkbook. To write a check, you fill out a form that looks like a paper check, and the check register looks like a paper register.

Date	Payee	Amount	Balance
10/01/92	James's Paycheck	1,500.00	1,500.00
10/01/92	ATM	25.00	1,475.00
10/01/92	James	1,500.00	2,975.00
10/01/92	James's Paycheck	1,500.00	4,475.00
10/01/92	ATM	25.00	4,450.00
10/01/92	James	1,500.00	5,950.00
10/01/92	James's Paycheck	1,500.00	7,450.00
10/01/92	ATM	25.00	7,425.00
10/01/92	James	1,500.00	8,925.00
10/01/92	James's Paycheck	1,500.00	10,425.00
10/01/92	ATM	25.00	10,400.00
10/01/92	James	1,500.00	11,900.00
10/01/92	James's Paycheck	1,500.00	13,400.00
10/01/92	ATM	25.00	13,375.00
10/01/92	James	1,500.00	14,875.00
10/01/92	James's Paycheck	1,500.00	16,375.00
10/01/92	ATM	25.00	16,350.00
10/01/92	James	1,500.00	17,850.00
10/01/92	James's Paycheck	1,500.00	19,350.00
10/01/92	ATM	25.00	19,325.00
10/01/92	James	1,500.00	20,825.00
10/01/92	James's Paycheck	1,500.00	22,325.00
10/01/92	ATM	25.00	22,300.00
10/01/92	James	1,500.00	23,800.00
10/01/92	James's Paycheck	1,500.00	25,300.00
10/01/92	ATM	25.00	25,275.00
10/01/92	James	1,500.00	26,775.00
10/01/92	James's Paycheck	1,500.00	28,275.00
10/01/92	ATM	25.00	28,250.00
10/01/92	James	1,500.00	29,750.00
10/01/92	James's Paycheck	1,500.00	31,250.00
10/01/92	ATM	25.00	31,225.00
10/01/92	James	1,500.00	32,725.00
10/01/92	James's Paycheck	1,500.00	34,225.00
10/01/92	ATM	25.00	34,200.00
10/01/92	James	1,500.00	35,700.00
10/01/92	James's Paycheck	1,500.00	37,200.00
10/01/92	ATM	25.00	37,175.00
10/01/92	James	1,500.00	38,675.00
10/01/92	James's Paycheck	1,500.00	40,175.00
10/01/92	ATM	25.00	40,150.00
10/01/92	James	1,500.00	41,650.00
10/01/92	James's Paycheck	1,500.00	43,150.00
10/01/92	ATM	25.00	43,125.00
10/01/92	James	1,500.00	44,625.00
10/01/92	James's Paycheck	1,500.00	46,125.00
10/01/92	ATM	25.00	46,100.00
10/01/92	James	1,500.00	47,600.00
10/01/92	James's Paycheck	1,500.00	49,100.00
10/01/92	ATM	25.00	49,075.00
10/01/92	James	1,500.00	50,575.00
10/01/92	James's Paycheck	1,500.00	52,075.00
10/01/92	ATM	25.00	52,050.00
10/01/92	James	1,500.00	53,550.00
10/01/92	James's Paycheck	1,500.00	55,050.00
10/01/92	ATM	25.00	55,025.00
10/01/92	James	1,500.00	56,525.00
10/01/92	James's Paycheck	1,500.00	58,025.00
10/01/92	ATM	25.00	57,999.99
10/01/92	James	1,500.00	59,499.99
10/01/92	James's Paycheck	1,500.00	60,999.99
10/01/92	ATM	25.00	60,974.99
10/01/92	James	1,500.00	62,474.99
10/01/92	James's Paycheck	1,500.00	63,974.99
10/01/92	ATM	25.00	63,949.99
10/01/92	James	1,500.00	65,449.99
10/01/92	James's Paycheck	1,500.00	66,949.99
10/01/92	ATM	25.00	66,924.99
10/01/92	James	1,500.00	68,424.99
10/01/92	James's Paycheck	1,500.00	69,924.99
10/01/92	ATM	25.00	69,899.99
10/01/92	James	1,500.00	71,399.99
10/01/92	James's Paycheck	1,500.00	72,899.99
10/01/92	ATM	25.00	72,874.99
10/01/92	James	1,500.00	74,374.99
10/01/92	James's Paycheck	1,500.00	75,874.99
10/01/92	ATM	25.00	75,849.99
10/01/92	James	1,500.00	77,349.99
10/01/92	James's Paycheck	1,500.00	78,849.99
10/01/92	ATM	25.00	78,824.99
10/01/92	James	1,500.00	80,324.99
10/01/92	James's Paycheck	1,500.00	81,824.99
10/01/92	ATM	25.00	81,799.99
10/01/92	James	1,500.00	83,299.99
10/01/92	James's Paycheck	1,500.00	84,799.99
10/01/92	ATM	25.00	84,774.99
10/01/92	James	1,500.00	86,274.99
10/01/92	James's Paycheck	1,500.00	87,774.99
10/01/92	ATM	25.00	87,749.99
10/01/92	James	1,500.00	89,249.99
10/01/92	James's Paycheck	1,500.00	90,749.99
10/01/92	ATM	25.00	90,724.99
10/01/92	James	1,500.00	92,224.99
10/01/92	James's Paycheck	1,500.00	93,724.99
10/01/92	ATM	25.00	93,699.99
10/01/92	James	1,500.00	95,199.99
10/01/92	James's Paycheck	1,500.00	96,699.99
10/01/92	ATM	25.00	96,674.99
10/01/92	James	1,500.00	98,174.99
10/01/92	James's Paycheck	1,500.00	99,674.99
10/01/92	ATM	25.00	99,649.99
10/01/92	James	1,500.00	101,149.99
10/01/92	James's Paycheck	1,500.00	102,649.99
10/01/92	ATM	25.00	102,624.99
10/01/92	James	1,500.00	104,124.99
10/01/92	James's Paycheck	1,500.00	105,624.99
10/01/92	ATM	25.00	105,599.99
10/01/92	James	1,500.00	107,099.99
10/01/92	James's Paycheck	1,500.00	108,599.99
10/01/92	ATM	25.00	108,574.99
10/01/92	James	1,500.00	110,074.99
10/01/92	James's Paycheck	1,500.00	111,574.99
10/01/92	ATM	25.00	111,549.99
10/01/92	James	1,500.00	113,049.99
10/01/92	James's Paycheck	1,500.00	114,549.99
10/01/92	ATM	25.00	114,524.99
10/01/92	James	1,500.00	116,024.99
10/01/92	James's Paycheck	1,500.00	117,524.99
10/01/92	ATM	25.00	117,499.99
10/01/92	James	1,500.00	118,999.99
10/01/92	James's Paycheck	1,500.00	120,499.99
10/01/92	ATM	25.00	120,474.99
10/01/92	James	1,500.00	121,974.99
10/01/92	James's Paycheck	1,500.00	123,474.99
10/01/92	ATM	25.00	123,449.99
10/01/92	James	1,500.00	124,949.99
10/01/92	James's Paycheck	1,500.00	126,449.99
10/01/92	ATM	25.00	126,424.99
10/01/92	James	1,500.00	127,924.99
10/01/92	James's Paycheck	1,500.00	129,424.99
10/01/92	ATM	25.00	129,399.99
10/01/92	James	1,500.00	130,899.99
10/01/92	James's Paycheck	1,500.00	132,399.99
10/01/92	ATM	25.00	132,374.99
10/01/92	James	1,500.00	133,874.99
10/01/92	James's Paycheck	1,500.00	135,374.99
10/01/92	ATM	25.00	135,349.99
10/01/92	James	1,500.00	136,849.99
10/01/92	James's Paycheck	1,500.00	138,349.99
10/01/92	ATM	25.00	138,324.99
10/01/92	James	1,500.00	139,824.99
10/01/92	James's Paycheck	1,500.00	141,324.99
10/01/92	ATM	25.00	141,299.99
10/01/92	James	1,500.00	142,799.99
10/01/92	James's Paycheck	1,500.00	144,299.99
10/01/92	ATM	25.00	144,274.99
10/01/92	James	1,500.00	145,774.99
10/01/92	James's Paycheck	1,500.00	147,274.99
10/01/92	ATM	25.00	147,249.99
10/01/92	James	1,500.00	148,749.99
10/01/92	James's Paycheck	1,500.00	150,249.99
10/01/92	ATM	25.00	150,224.99
10/01/92	James	1,500.00	151,724.99
10/01/92	James's Paycheck	1,500.00	153,224.99
10/01/92	ATM	25.00	153,199.99
10/01/92	James	1,500.00	154,699.99
10/01/92	James's Paycheck	1,500.00	156,199.99
10/01/92	ATM	25.00	156,174.99
10/01/92	James	1,500.00	157,674.99
10/01/92	James's Paycheck	1,500.00	159,174.99
10/01/92	ATM	25.00	159,149.99
10/01/92	James	1,500.00	160,649.99
10/01/92	James's Paycheck	1,500.00	162,149.99
10/01/92	ATM	25.00	162,124.99
10/01/92	James	1,500.00	163,624.99
10/01/92	James's Paycheck	1,500.00	165,124.99
10/01/92	ATM	25.00	165,099.99
10/01/92	James	1,500.00	166,599.99
10/01/92	James's Paycheck	1,500.00	168,099.99
10/01/92	ATM	25.00	168,074.99
10/01/92	James	1,500.00	169,574.99
10/01/92	James's Paycheck	1,500.00	171,074.99
10/01/92	ATM	25.00	171,049.99
10/01/92	James	1,500.00	172,549.99
10/01/92	James's Paycheck	1,500.00	174,049.99
10/01/92	ATM	25.00	174,024.99
10/01/92	James	1,500.00	175,524.99
10/01/92	James's Paycheck	1,500.00	177,024.99
10/01/92	ATM	25.00	176,999.99
10/01/92	James	1,500.00	178,499.99
10/01/92	James's Paycheck	1,500.00	180,000.00
10/01/92	ATM	25.00	179,975.00
10/01/92	James	1,500.00	181,475.00
10/01/92	James's Paycheck	1,500.00	182,975.00
10/01/92	ATM	25.00	182,950.00
10/01/92	James	1,500.00	184,450.00
10/01/92	James's Paycheck	1,500.00	185,950.00
10/01/92	ATM	25.00	185,925.00
10/01/92	James	1,500.00	187,425.00
10/01/92	James's Paycheck	1,500.00	188,925.00
10/01/92	ATM	25.00	188,900.00
10/01/92	James	1,500.00	190,400.00
10/01/92	James's Paycheck	1,500.00	191,900.00
10/01/92	ATM	25.00	191,875.00
10/01/92	James	1,500.00	193,375.00
10/01/92	James's Paycheck	1,500.00	194,875.00
10/01/92	ATM	25.00	194,850.00
10/01/92	James	1,500.00	196,350.00
10/01/92	James's Paycheck	1,500.00	197,850.00
10/01/92	ATM	25.00	197,825.00
10/01/92	James	1,500.00	199,325.00
10/01/92	James's Paycheck	1,500.00	200,825.00
10/01/92	ATM	25.00	200,800.00
10/01/92	James	1,500.00	202,300.00
10/01/92	James's Paycheck	1,500.00	203,800.00
10/01/92	ATM	25.00	203,775.00
10/01/92	James	1,500.00	205,275.00
10/01/92	James's Paycheck	1,500.00	206,775.00
10/01/92	ATM	25.00	206,750.00
10/01/92	James	1,500.00	208,250.00
10/01/92	James's Paycheck	1,500.00	209,750.00
10/01/92	ATM	25.00	209,725.00
10/01/92	James	1,500.00	211,225.00
10/01/92	James's Paycheck	1,500.00	212,725.00
10/01/92	ATM	25.00	212,700.00
10/01/92	James	1,500.00	214,200.00
10/01/92	James's Paycheck	1,500.00	215,700.00
10/01/92	ATM	25.00	215,675.00
10/01/92	James	1,500.00	217,175.00
10/01/92	James's Paycheck	1,500.00	218,675.00
10/01/92	ATM	25.00	218,650.00
10/01/92	James	1,500.00	220,150.00
10/01/92	James's Paycheck	1,500.00	221,650.00
10/01/92	ATM	25.00	221,625.00
10/01/92	James	1,500.00	223,125.00
10/01/92	James's Paycheck	1,500.00	224,625.00
10/01/92	ATM	25.00	224,600.00
10/01/92	James	1,500.00	226,100.00
10/01/92	James's Paycheck	1,500.00	227,600.00
10/01/92	ATM	25.00	227,575.00
10/01/92	James	1,500.00	229,075.00
10/01/92	James's Paycheck	1,500.00	230,575.00
10/01/92	ATM	25.00	230,550.00
10/01/92	James	1,500.00	232,050.00
10/01/92	James's Paycheck	1,500.00	233,550.00
10/01/92	ATM	25.00	233,525.00
10/01/92	James	1,500.00	235,025.00
10/01/92	James's Paycheck	1,500.00	236,525.00
10/01/92	ATM	25.00	236,500.00
10/01/92	James	1,500.00	238,000.00
10/01/92	James's Paycheck	1,500.00	239,500.00
10/01/92	ATM	25.00	239,475.00
10/01/92	James	1,500.00	240,9

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First Looks

Toshiba

CONTINUED FROM PAGE 37

vendors are rushing to add to their systems to find market niches (PCMCIA slots, docking station connectors, and the like).

Next in the line is the beefed-up T1850 with a 25-MHz 386SX processor, an 80MB Toshiba hard disk, and 4MB RAM (expandable to 12MB) for \$2,199. Options include a 120MB disk, a \$259 internal 2,400-bps modem, a \$329 fax/modem, up to 12MB of memory, DOS 5.0, Windows 3.1, and a Logitech Trackman pointing device.

NEW PASSIVE-MATRIX COLOR

The \$3,299 T1850C is Toshiba's first passive-matrix color notebook (Toshiba first used passive-matrix technology in the 1990 T5200C luggable). It competes squarely with other passive-matrix color machines, such as Dell's \$3,999 325NC, AST's PremiumExec \$3,995 386SX/25C, and ALR's new \$2,949 486SX-based Ranger MC45X/20. For \$3,299, you get 4MB RAM (upgradable to 16MB), an 80MB hard disk with an option for 120MB, DOS 5.0, Windows 3.1, and the Logitech Trackman. The color LCD panel adds more height and weight, bringing the system up to a total of 7.3

FACT FILE

Toshiba

Satellite Series

Toshiba America Information Systems, Inc., 9740 Irvine Blvd., Irvine, CA 92718; 800-334-3445, 714-583-3000; fax, 714-587-6034

List price: T1800 with 2MB RAM, 60MB hard disk, \$1,799; T1850 with 4MB RAM, 80MB hard disk, \$2,199; T1850C with 4MB RAM, 80MB hard disk, DOS 5.0, Windows 3.1, \$3,299.

In short: The Satellite Series, Toshiba's first attempt to play in the competitive low-cost notebook arena, succeeds, especially in the case of the \$3,299 color T1850C, which has one of the best passive-matrix displays we've seen.

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Benchmark Test: Toshiba Satellite T1850C

The Toshiba T1850C's bright passive-matrix color display reveals good video performance. In our worst-case battery rundown scenario, however, it gobbles power as hungrily as the active-matrix Compaq LTE Lite/25C. Overall performance of the system is in line with other passive-matrix notebooks PC Labs has recently tested, like the Dell and AST models noted below.

We used PC Magazine Labs' Hardware Performance Tests, Release 6.0, to measure each PC's processor, memory, disk, and video subsystem performance. The Graphics Winmark is the geometric mean of 12 Windows-based graphics tests from WINBENCH 2.5, weighted to reflect how frequently various functions are used.

	Processor (operations per second)	Memory (kilobytes per second)	Disk (kilobytes per second)	Video (thousands of operations per second)	Winmark (megapixels per second)	Battery Rundown (hours: minutes)
Compaq LTE Lite/25C (25-MHz 386SL active-matrix color)	130	2,911	86	3,105	1.82	1:37
Dell System 325NC (25-MHz 386SL passive-matrix color)	130	2,903	166	1,391	1.35	2:53
386SX/SL/25-MHz average	120	2,381	91	1,195	1.12	N/A
Toshiba T1850C (25-MHz 386SX passive-matrix color)	119	1,994	80	3,188	1.95	1:50
AST Premium Exec 386SX/25C (25-MHz Am386SL passive-matrix color)	112	2,195	88	1,900	1.13	2:12

N/A—Not applicable: PC Magazine Labs has not yet run the test on enough machines of this type to compute a meaningful average score.

pounds. We tested a sample T1850C, not a production unit.

On PC Labs' Hardware Performance Tests, the T1850C scored between the AST and Dell color notebooks. It was especially strong in the video test and had one of the higher scores on the Windows-based Graphics Winmark test.

Compared with other passive-matrix color notebooks, the T1850C had a lower score on PC Labs' disk test. This is because Toshiba is using noncached hard disks. It also scored toward the bottom of the memory test when compared with the others because most of them are cached systems.

The quality of the 9.5-inch passive-matrix LCD panel on the T1850C is quite good. While the colors it produces can't compare to the fully saturated colors of an active-matrix screen, it looks respectable when seen side by side with an active-matrix screen, and for the \$3,299 price, the T1850C's colors are more than adequate.

The screen displays 16 colors out of a palette of 226,981 (most active-matrix panels display 256 colors) and looks quite good under Windows. It's still subject to passive-matrix's shortcomings, such as crosstalk (ghosting at the corners of dialog boxes un-

der Windows boxes) and somewhat washed-out color. It's a fast screen and doesn't lose the mouse through submarining; that is, when the cursor disappears off the screen as you move the mouse quickly.

Toshiba is bundling a font utility that takes advantage of the VGA's 480-line capabilities.

Strangely, the T1850C doesn't allow simultaneous display to the screen and an external monitor. That's a feature all color notebooks should have, since they are so often used for presentations.

All Satellites come with a full set of ports, including parallel, serial, VGA, PS/2 mouse, and keypad. New on the Satellites are sliding port covers that won't fall or break off, a nice design feature. Also included is a slot to put a locking cable in so you can lock the system to a desk. Of course, all Satellites use Toshiba's fabulous 82-key keyboard, the same one used in the 2200, 3300, and 4400 series of machines.

Even though the Satellites use 386SX processors instead of more expensive 386SLs (the price difference seems to be hovering at around \$200), Toshiba has included a full arsenal of power-saving features and utilities. AutoResume,

which lets you turn your notebook off and remembers where you were when you turn it back on, works under DOS or Windows. Utilities let you set the interval when the screen, disk, and CPU can be powered down.

Using nickel cadmium batteries, the T1800 and T1850 are rated by Toshiba to last 3 to 4 hours in a worst-case scenario without any power saving enabled. The passive-matrix T1850C is rated to last more than 2 hours, and the sample unit we tested lasted close to that. The AC adapter is slightly bigger than the small unit used by the T2200SX, but it remains smaller than the adapters used by much of the competition.

The system can be fully charged in about 2 hours, but only if the machine is not in use. Toshiba has included a micro-processor to monitor the charging of the battery. It keeps the battery from overcharging and helps maintain a low charging temperature.

If you're shopping for a notebook and have always been attracted by Toshiba's reputation for quality but repelled by the relatively high prices of its systems, now is the time to look. The Satellite series brings Toshiba's noteworthy workmanship to a wider audience. □



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Monitor	UVGA-NI	No	UVGA15-NI	UVGA-NI
Hard Drive	210MB	210MB	230MB	340MB SCSI
Expansion Slots	(8) 5 EISA/2 ISA/1 P	4 EISA	6 EISA	8 EISA
Local Bus/Flash BIOS	Yes/Yes	Yes/Yes	No/No	No/No
MSRP*	\$3,299	\$3,695	\$3,469	\$3,595

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Mapping Software

MapExpert: Every U.S. Street Visible Through Windows

BY EDWARD MENDELSON

DeLorme Mapping's \$495 MapExpert combines a CD-ROM that maps every street in the United States with Windows software that lets you search for streets and zoom, mark, annotate, and print maps of the areas you select.

The program uses the same map data used by DeLorme's earlier and still available Street Atlas USA, a \$169 product that lets you view maps and export them to other Windows applications but doesn't offer the advanced features found in MapExpert.

When you first open MapExpert or Street Atlas USA, you see a map of the entire United States, including Alaska and Hawaii. Using menu commands or a toolbox, you zoom through 16 preset magnification levels to find the region you want. Searching for regions by ZIP code, telephone ex-

change, or city name is also possible.

A panning/zooming tool lets you choose the point on-screen that you want to be the center point of the display, or the area that you want to view in greater detail. At larger scales you can search for street names or, in any of 300 large cities, house numbers. The larger-scale displays also show prominent buildings and route numbers.

Unlike Street Atlas USA, MapExpert supports Windows' Multiple Document Interface, which lets you keep maps of several different regions (or different magnifications of the same region) open at once. You can iconize maps if you don't need them.

Potentially the most useful feature in MapExpert is its ability to add markings, notes, symbols, and new features to any map. You can't modify or remove data from the CD-ROM, but the program lets you create overlay files that add standard map symbols such as airfields and picnic grounds, geographic features, new streets, or boxes containing text.

You can add text directly over a map, without a box, and rotate it to any angle. Even better, you get the tools to trace routes in the form of opaque or highlighter-style transparent lines.

Adding symbols and notes takes practice and patience.

There is an Undo feature, but to use it, you generally need to get out of the drawing mode and into a selection mode first. You may find that you enter the same note box twice and then have to delete one.

Maps print at any of the preset scales, either as single-page maps with a caption that you choose and a symbol legend supplied by the program, or as



SHOW ME THE WAY: MapExpert lets you draw highlighter-style markings and add notes.

what the program calls a mural, with multiple pages covering a single region. Maps can be exported to other Windows applications in bitmap or metafile format.

EVERY STREET

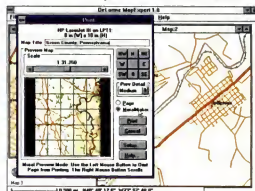
The map data that is on the CD-ROM, compiled from a variety of public and private sources that DeLorme won't identify, evidently lives up to its claim of including every street in America. MapExpert displayed every obscure rural street that my family knew about, including unnamed back roads simply designated "[Road]" on the display. But the data is inconsistent in different regions in its treatment of streets that have no buildings on them. The map of Manhattan shows none of the streets that cross Central Park, but you'll find all the streets in Golden Gate Park on the map of San Francisco.

The CD-ROM stores its map

data in the form of coordinates that mark the ends of each city block or each segment of a longer road, not as a conventional graphics image. This means that rounding errors make straight streets look as if they change direction slightly at every street corner, while curved streets appear as a series of straight line segments. Manhattan's Stuyvesant Oval looks like a distorted rectangle.

MapExpert finds and displays data at impressive speeds, but seems inefficient when redisplaying data it has already located. On a 33-MHz 486 system, most maps appeared 7 to 10 seconds after we specified an area code or city name. But if we moved a map area slightly, the program took 7 to 10 seconds to return to the CD-ROM for all the data needed to draw the new map—even though most of the data had been displayed on the earlier map and was already in memory.

Unlike other mapping programs, MapExpert can't be linked to external databases, so you can't use it for MapInfo-like maps that could color-code sales



OVER THE RIVER: You can print maps in mural form (as shown here) or on single pages.

figures for different regions. But it offers by far the least expensive map data available anywhere. Rival vendors offer maps of the whole United States for \$30,000 or more. If you simply want to display, print, and mark your maps, MapExpert is an amazing bargain. And the cheaper Street Atlas USA, with the same data but fewer frills, is another great deal and just as enjoyable to use. □

FACT FILE

MapExpert, Version 1.0

DeLorme Mapping, Main St., P.O. Box 298, Freeport, ME 04032; 800-452-5931, 207-865-1234; fax, 207-865-9628

List price: \$495.

Requires: 2MB RAM, 3MB hard disk space, DOS 4.01 or later, Microsoft Windows 3.0 or later, Windows and ISO 9660-compatible CD-ROM drive

In short: Every street in the United States, displayed quickly and easily on maps that you can mark up with symbols and captions. The most maps for the money from any software vendor.

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Quarterdeck

■ Multimedia

Sony's CD-ROM Player: Portable Multimedia for Consumers and Business

BY LORI GRUNIN

In the crossover market where consumer electronics weds computer technology, we've seen quite a few attempts to define the correct set of features at the right price. From the Philips CD-Interactive "infostation" approach, which has more in common with your Nintendo than your PC, to the MPC type of extended-capability computer and the vaporish personal digital assistants, no one has quite hit the nail on the head of mass-market consumers' needs.

Sony's latest attempt, the rather prosaically-named \$999.95 Multimedia CD Player (MMCD), a portable, stand-alone CD-ROM XA drive with a screen and keyboard, seems to be yet another device that adds to compatibility confusion without wholly meeting the needs of its potential users.

The MMCD measures 1.75 by 5.5 by 7.5 inches and weighs only 2.2 pounds (including battery). It uses a readable CGA-resolution 3- by 4-inch monochrome LCD screen that offers 7 shades of gray, and a QWERTY keyboard (with separate numeric keypad) that's small but suitable for entering the few words that comprise search queries. A large, easy-to-use cursor pad moves you around within a screen. No and Yes keys operate like Esc and Enter, and there are five function keys.

All programs run

off a CD, which you insert by lifting up the keyboard section. To power the MMCD, you can either run off one of the small camcorder-compatible nickel cadmium batteries, which last about 2 hours, or plug in the AC adapter.

Connections to the outside world include 256-color composite video output via an RCA jack, stereo output through speakers plugged into the minijack (you can also use the high-quality built-in mono speaker), and serial MMCD-to-PC communications via an RS-232 port (which requires software support).

BUSINESS BEFORE PLEASURE

As you might expect, the MMCD can also play standard audio CDs—the unit autoseeks the type of disc in the drive—and it contains easy-to-use ROM-based software for playing them. An 8088-compatible V20 processor allows the MMCD to play multimedia applications similar to those that run on your PC, but not without

▶ FACT FILE

Sony Multimedia CD-ROM Player

Sony Corp. of America, 1 Sony Dr., Park Ridge, NJ 07656; 800-352-7669, 201-930-1000

List price: Including Secrets of Power Negotiating and choice of one other title, \$999.95; Premium package, including The Wall Street Journal Guides to Business Travel: USA and Canada and choice of one of 12 additional titles, \$1,099.95.

In short: If you need a portable electronic reference device, you won't be disappointed with the light, attractive Multimedia CD-ROM Player. But ultimately, incompatibility with existing multimedia software and poor connectivity with PCs makes the Player best suited as a read-only tool for custom corporate data disks.

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some rewriting by the software vendor. You need to be wary when buying off-the-shelf applications, and make sure they

bear the MMCD Player Software logo.

Sony stresses that the MMCD player is *not* intended as a PC peripheral, and expects to see companies developing in-house applications, predominantly electronic versions of corporate reference materials. To this end, Microsoft is offering a version of its Multimedia Viewer authoring product.

The application bundled with the unit—IBM's Secrets of Power Negotiating—confirms this strong business orientation. Although you also get a coupon to choose among Random House's The Civil War, Compton NewMedia's Let's Go USA, or the King James Bible, most of the initial applications to ship for the unit have titles such as Secrets of Power Negotiating and A Corporate Guide to the Environment (IBM, \$49.95 each). Sony has commitments from ten companies to ship over 60 titles by the end of this year (with prices ranging from \$25 to \$350).

While you can hook it up to an external monitor to make it easier on the eyes, the MMCD is a read-only device and therefore can't replace a laptop computer; you'll still have to tote them both. And, most damaging, the MMCD can't act as an external CD-ROM XA drive for your laptop.

While Sony's Multimedia CD Player certainly deserves kudos as a first-generation nexus for microcomputers, consumer electronics, and U.S. business, the MMCD seems to carry too high a price tag (even at any probable street price) given its off-the-shelf incompatibility with any current product on the market.

There's no current globally recognized standard for products running CD-based applications that integrate audio and graphics, so Sony's mix of high-end (CD-ROM XA) and low-end (monochrome CGA) hardware means the company will be fighting an uphill battle with most of the competition, though it certainly has the resources to win.

For companies with the money to spend on a fleet of MMCDs and a driving need to do away with paper, the Sony Multimedia CD-ROM Player will provide a satisfactory solution. But the rest of us will just have to wait until the rain of products abates and we see what remains standing after the flood. □



WALKMAN 2000P: The Sony Multimedia CD-ROM player is targeted at custom applications, but it plays audio CDs, too.

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- Monitor sold separately



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Available at participating Radio Shack stores and dealers.



Want a double layer of power? Our Tandy 4850 EP comes with the same features as the 4825 SX. But with the Intel 486™ DX2™ micro-processor as the key ingredient, you get the combined firepower of 50MHz clock speed and a built-in math co-processor. You'll fly through programs up to four times faster than 386 PCs! Plus, we've topped it off by installing Microsoft Works for word-processing, database, ready-to-run spreadsheet, and graphics applications.

And like every Tandy PC, the 4850 EP is engineered to the most demanding specs in the industry and manufactured in one of Tandy's 21 USA manufacturing plants. At a terrific price, you can experience our most powerful PC yet. With Tandy, you don't have to just settle for what you need—you can get what you want. The Intel Inside Logo is a trademark of Intel Corporation.

...AND EAT IT TOO.

■ Databases

PrimaBase: \$349 Database Needs More Features

BY RICHARD HALE SHAW

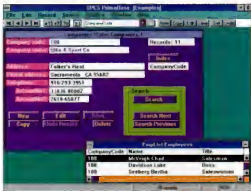
The latest Windows database to appear on the scene is Scandinavia PC Systems' \$349 SPCS PrimaBase, a program that has its virtues, but not enough of them to make it stand out in a growing crowd.

PrimaBase features a multi-window interface, speed buttons for easy navigation, and query-by-form (QBF) for database searches. You can switch between file indexes, link multiple files, view them in multiple windows (one file per window), and save and restore the arrangement of windows or views.

The program uses its own file format, but it lets you save windows, forms, and reports with 16-character filenames. Import and export formats include text, .DIF, and dBASE files, but

not Paradox files.

PrimaBase opens up to 9 file windows at a time with up to 15 indexes per file. All indexes are automatically updated as you enter/edit records, regardless of which index is in use at the time. And PrimaBase offers a built-in utility for backing up and restoring all or part of a database, with



FORM FACTOR: PrimaBase's Form Editor lets you define custom multifile forms.

on-the-fly data compression.

Creating multiple links is easy, but not nearly as intuitive as with Approach for Windows or products that hide the dirty work. With PrimaBase, you must create the link fields, specify the link between them, and create the appropriate indexes.

Switching between indexes is simple, however: Just select the one you want from a combo box. PrimaBase's QBF couldn't be easier: Click on the Search button, enter the search criteria into the appropriate field(s), and click on either Search Forward or Search Backward.

For multisite users, SPCS offers a network version available for most NetBIOS-compatible networks, and can accommodate up to 32 simultaneous users.

PrimaBase has its faults. It

doesn't let you use all the standard Windows controls (such as combo boxes) in forms, supports only a limited form of DDE, and doesn't support OLE at all. You can't integrate graphics into your forms, combine fields from linked files in the same form window, or produce cross tabs or graphs.

There are no memo fields or macros, and the mail-merge feature supports only the MS-Write format; you'll have to convert your word processing files before you mail-merge them.

PrimaBase doesn't pack the power you can get for \$50 more with Approach. The program needs an injection of features or a lower price before it can threaten its competition.

• **List price:** SPCS PrimaBase, Version 3.0, \$349; five-user version, \$1,500. Requires: 2MB RAM, 2MB hard disk space, Microsoft Windows 3.0 or later, Scandinavian PC Systems, P.O. Box 3156, Baton Rouge, LA 70821; 800-487-7727, 504-338-9580; fax, 504-338-9670.

Circle 418 on reader service card

■ Word Processing

Button Cube: Easier Access to WordPerfect for Windows

BY SALLY NEUMAN

The Button Cube, an \$89.95 utility from Software Workshop, lets you access any feature or function of WordPerfect for Windows with the click of a mouse. By creating a free-floating, multisided cube and covering it with icons, you can bring as many WordPerfect features as you want within easy reach.

The Button Cube ships with a Master Button Palette, which lets you select from among hundreds of buttons to describe visually the task or command you want to perform. Buttons are grouped logically into sets for Text, Layout/Fonts, Graphics, System, Special Characters, and Macros.

Anything you can do in WordPerfect for Windows can

be accessed through a button with The Button Cube. Handy shortcuts to features such as Print, Spell Check, Run Macro, Page Preview, and other functions are available. But more than that, things you cannot do with keystrokes and mouse clicks can be performed by a button.

Design a table and move your text into the proper rows and columns with one mouse click. Block a section of text, turn on Spell Check, and then send the block of text to print with another mouse click. Save your document with a third mouse click. The Button Cube can automate it all.

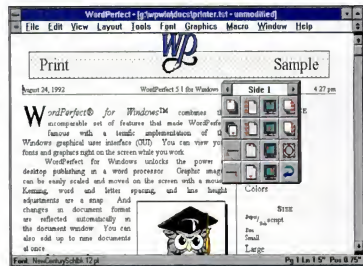
Customizing or editing an existing cube is simple with The Button Cube's Configure utility. With the versatile Create utility,

you can easily design cubes for working with text, with macros, or even with project themes.

Whether you're a WordPerfect power user looking for greater speed in your word processing or a new user seeking ways to make your word processing smoother, The Button Cube can make your job easier.

• **List price:** The Button Cube, Version 1.0, \$89.95. Requires: 2MB RAM, 1.5MB hard disk space, Microsoft Windows 3.0 or later, WordPerfect for Windows 5.1, Software Workshop Inc., 75 S. Mountain Way Dr., #114, Orem, UT 84058; 800-762-9550, 801-224-6865; fax, 801-224-2506.

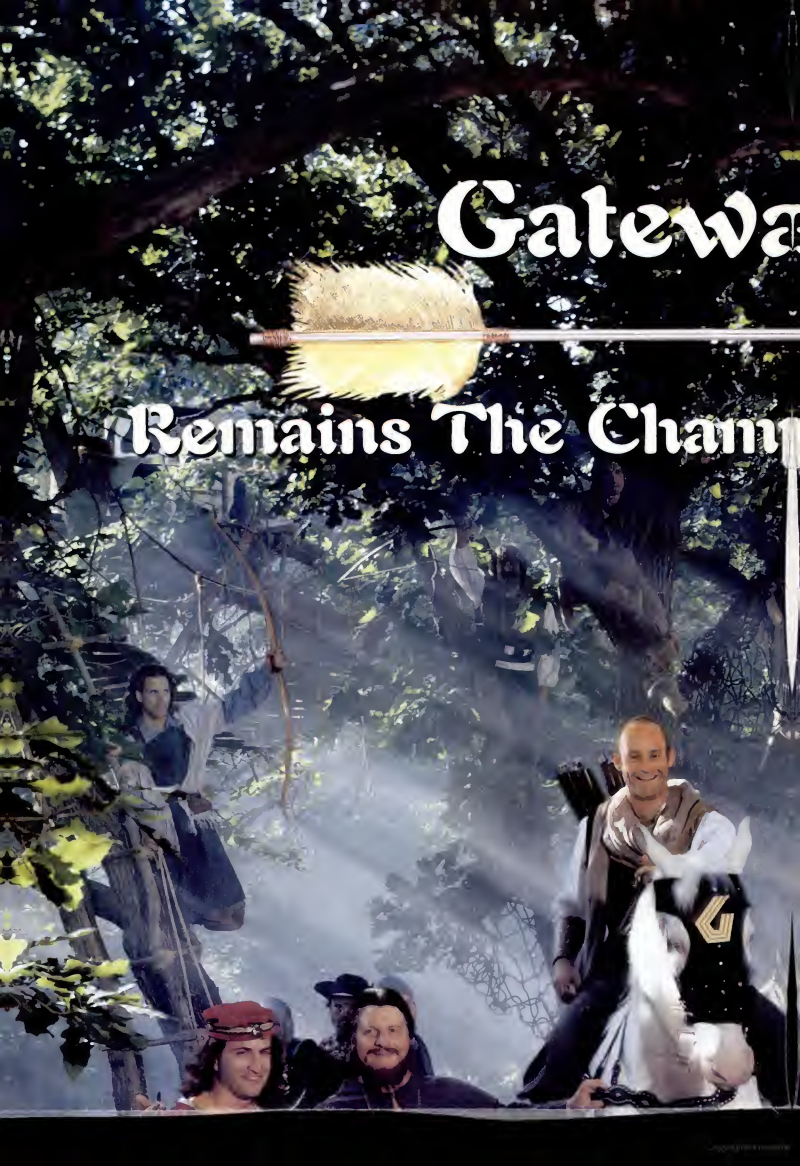
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 2. Arrow pointing to the fold
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4. Close the page and slip-sheet



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■ Multimedia

MpcOrganizer Opens Windows to Multimedia Files

BY JAMES KARNEY

Putting together a multimedia presentation can be a frustrating experience. You've got to locate and organize a variety of files in a host of different formats. Lenel Systems' MpcOrganizer is a \$249 Windows database that catalogs, locates, reports, and displays almost any type of text, image, animation, video, or sound on a multimedia PC.

But it's not just a database. MpcOrganizer is also an OLE (Object Linking and Embedding) server that lets you paste multimedia files into any Windows application that supports OLE as a client.

The interface is simple, if not totally intuitive. Menus control access to databases, and windows display images or reports.

MpcOrganizer uses Borland's Paradox engine to build databases containing information records about multimedia objects. You can search for objects based on name, theme, description, or keyword. Once you locate an object, you can display it or listen to it, provided your computer has the required equipment.

Adding objects to a database is very simple: Open a new object dialog box, locate the file with Windows' File Manager, and drag the file icon into the blank record.

To locate a multimedia file, you enter the

search string in an empty record dialog box and issue a search command. If a match is made, the program asks if you want to display or listen to the selection. You are also able to group objects as a collection within a database, which can be very handy when designing a presentation.

Our searches on a sample database were quick and straightforward. We encountered some problems when loading EPS files, but the program located, displayed, and played without difficulty a wide variety of

bitmapped images, MIDI clips, .FLI animations, and CD sounds.

MpcOrganizer handles most popular bitmap, vector, Autodesk animation, and sound formats, as well as still and full-motion video. These include CD audio, CGM, EPS, .GIF, .IMG, MIDI, tape, TIFF, .WAV, and .WPG. Video sources include still digital, full-motion analog, live, any Windows-supported MCI overlay board, and Microsoft AVI.

MpcOrganizer is very useful for anyone who maintains a large volume of multimedia material or is involved in producing complex presentations.

• **List price:** *MpcOrganizer Series 2, Version 1.1*, \$249. Requires: 4MB RAM, 7MB hard disk space, Microsoft Windows with Multimedia Extensions, DOS 3.1 or later (with Share). Lenel Systems International Inc., 19 Tobey Village Office Park, Pittsford, NY 14534; 716-248-9720; fax, 716-248-9185.

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DATABASE: Sort multimedia objects.

■ Printing Utilities

PrimeType Lets WordPerfect Use PostScript Fonts with Any Printer Quickly

BY EDWARD MENDELSON

LaserTools Corp.'s \$99.95 PrimeType for WordPerfect lets you use any PostScript Type 1 scalable fonts with WordPerfect for DOS on any non-PostScript laser or dot matrix printer—just as Adobe Type Manager lets you use PostScript Type 1 fonts with Windows and any non-PostScript printer. But PrimeType surpasses ATM by printing at a startling speed.

The program comes with a copy of ATM in the box, so you can get WYSIWYG screen fonts in Windows while using PrimeType itself to print from WordPerfect for Windows using WordPerfect printer drivers.

(PrimeType doesn't affect WordPerfect's DOS preview fonts.) You also get 20 Type 1 fonts from Adobe.

Under DOS, PrimeType works like Bitstream's FaceLift for WordPerfect, which uses

Speedo fonts, and LaserTools's Fonts-on-the-Fly, which uses PCL 5 Intellifonts. It wraps around WordPerfect, intercepts print data, and generates the required fonts inside your CPU, then sends them to the printer with your document. You can also load PrimeType separately as a 15K terminate-and-stay-resident program instead of loading it each time you run WordPerfect.

If you use an HP-compatible laser, PrimeType creates PCL 4 bitmap fonts, which it downloads once and continues to use for the rest of the session.

Your output speed depends on the speed of your computer. On a 33-MHz 486 system printing to a LaserJet III, PrimeType took 22 seconds to print a page with five soft fonts from DOS WordPerfect, and 1 second

more with WordPerfect for Windows. The same document and fonts, when printed as a PostScript file using HP's LaserJet PostScript Cartridge Plus, needed 1 minute 49 seconds to download and print.

Fonts from Adobe install perfectly, with a larger character set than you get with Adobe's installer.

The fonts in the package are the standard PostScript 13, plus 7 popular designs such as Tekton and Adobe Garamond (in one or two weights only). You can add any of 20,000 Type 1 fonts from any vendor. This flexibility, combined with PrimeType's speed, output quality, and ease of use, make it the best DOS font product on the market.

• **List price:** *PrimeType for WordPerfect*, \$99.95. Requires: 640K RAM, DOS 3.0 or later. LaserTools Corp., 1250 45th St., Emeryville, CA 94608; 800-767-8004, 510-420-8777; fax, 510-420-1150.

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SAMPLER: A look at the typefaces.

Forms Software

PerForm Pro Plus: Where Forms and Databases Meet

BY ALFRED POOR

Delrina Technology calls its new \$399 PerForm Pro Plus package "push-button forms with intelligence." Most users who look at it are likely to call it "almost a Windows database-management program." Whatever you call it, it has impressive features that are remarkably easy to use and probably difficult to outgrow.

As the name implies, the program revolves around forms: lines and labels and lots of blanks to fill in. The information entered on a form is entered into a data file, and PerForm Pro Plus is a polyglot: It can read from and write to comma- or tab-delimited ASCII, dBASE, Paradox, or Clipper files. (Delrina plans to add support for SQL files as well in the near future.) Why call it a database? Because you can create and maintain your data files without access to a separate database, such as dBASE or Paradox.

The program has two separate modules, Designer and

Filler. Designer is for creating your forms; Filler is for data entry and management tasks.

Designer has all the earmarks of a powerful and flexible Windows application. There are the traditional pull-down menus, but most commands also have shortcut keystrokes associated with them. There's also a status bar below the menu line that provides pull-down lists of operations such as text formatting or border definition; when you select one of these, the status bar shows buttons that provide one-click access to a variety of options.

Designer includes a toolbox of icons for various tasks such as text labels, defining data entry fields, and inserting graphics, among others. There are "comb" tools that make it quick and easy to define multiple row and column entry layouts (as opposed to a table editor), and you don't need to define the fields for each line, since one definition at the top of each column is sufficient.

Powerful field definition features are available. You can define calculated fields, default values, limiting ranges, entry edit masks, and automatic formatting. You can define a field as compulsory, or you can prevent the operator from changing data in a field—as you might do with the total field on an invoice.

WINDOWS DATABASE FEATURES

It's when you get to the database-related features that the program begins to flex its muscles. You can limit field entries to predetermined lists of values, or you can use an existing database as a lookup table

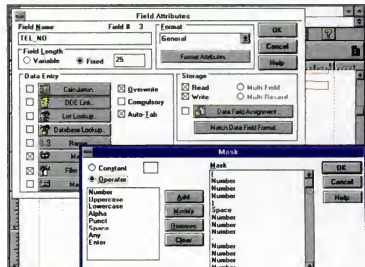
for verification. You can also bring back related data, such as the address information for a customer. The program supports one-to-many and many-to-one relationships between files, and can even relate data between files in different formats, such as ASCII and dBASE.

This power is relatively easy to access, since the program takes an object-oriented approach. Once you have defined an object for an invoice form that produces a serialized number that cannot be altered by the operator, or a date field that has

even more customization possible. You can design your own custom menus in Filler to hide unwanted menu options or to add new commands for specific applications.

There is a macro recorder that creates commands using a language similar to the one that Word for Windows uses to create WordBasic macros. You can edit and alter these macros so that they can perform complex procedures, and you can assign macros to menu items or on-screen buttons that the users can click on with the mouse.

The program also knows



FILL-IN THE FIELDS: PerForm Pro Plus has a wide range of powerful field definition features for designing custom forms.

the label and formatting that you want, you can save these items as separate objects in a library and then add them to forms you develop in the future.

Delrina includes libraries containing dozens of objects, from field definitions to graphical images. The program also comes with more than 100 forms that you can use as starting points for your own designs. The program's support of DDE and OLE adds to its flexibility and power; you can embed your company's logo or address as an object in all your forms, and if the logo or address should change, you only have to change the item once and all your forms will be automatically updated.

All this power makes it easier for users to complete the forms using Filler, but there's

how to communicate. Delrina has bundled WinFax Pro 2.0 with the program, so you can fax completed forms as easily as you can print them, if you have a fax modem.

PerForm Pro Plus is designed to work across a network—it even knows to ask where your shared Paradox directory can be found—and you can purchase additional licenses in quantity at a discount. Delrina is planning to add support for LAN E-Mail applications so that users will be able to send forms, data, or both across the network.

If you're looking for a way to create attractive data forms, to fill them out on-screen, and to store their data on disk in standard database format files, this is one product that can do the job well. □

FACT FILE

PerForm Pro Plus

Delrina Technology Inc.,
6830 Via Del Oro, 240,
San Jose, CA 95119; 800-268-
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■ Multimedia

Two Asymetrix Packages Under \$100 Make Multimedia Experiments Easy

BY PETER SCISCO

Creating eye-catching, attention-grabbing multimedia extravaganzas has become a little easier—and a lot cheaper—with two new products from Asymetrix: Multimedia Make Your Point and MediaBlitz!. For about the price of the latest computer golf game, Windows users, both experienced and inexperienced, can link sound effects, music, narration, animation, pictures, and text to build professional and effective displays quickly and almost painlessly.

Although both of these products are close in price (there's only a \$6 difference between the two, and each lists for under \$100), they occupy opposite ends of the multimedia presentation spectrum. Multimedia Make Your Point (MMYP) is the simpler of the two. It uses the text-based metaphor of a bullet-list presentation and pre-designed templates to create a direct and fast presentation builder.

MediaBlitz!, on the other hand, is more complex, employing the idea of a time line and using the metaphor of a video production unit. MMYP will appeal to users who are looking to create presentations quickly; MediaBlitz! is aimed at more experienced professionals with state-of-the-art hardware and multimedia libraries of clips and presentations.

MULTIMEDIA MAKE YOUR POINT

Creating a presentation with MMYP consists of a few simple steps. Working with screens, you enter a title and then text for secondary bullet items. To

enhance the look of the presentation, a Template Gallery provides a selection of basic designs, from sports motifs to urban skylines. The number of bullets available on any screen depends on the template used; for example, the Patriotic template includes room for four bullets, while the Any Occasion Black template uses only one bullet per screen.

Depending on the type of presentation you need, you can choose templates that rely more on buttons than on bullets. Each template's characteristics can be edited, including the color of buttons, the inclusion of graph-

ics you add your text to the title and the bullet lists, which appear as boxes on the screen. Different fonts and type sizes are supported, but the box does not expand to fit the text. A line that doesn't fit in the box will be truncated during the actual presentation. A warning message during the edit stage would have eliminated the need to launch the presentation before discovering the error.

MMYP enhances its text-based presentations by letting you associate events with specific actions. For example, a bullet item can be defined so that when it appears it is accompa-

nymp cannot link more than one effect to each action. You cannot, for example, define a button so that when activated it shows a graphics image and plays a .WAV file.

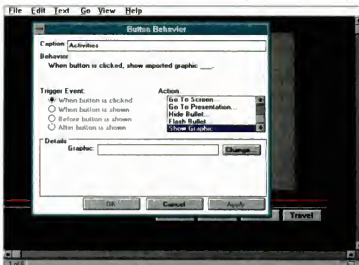
Bringing all of these elements together is easier than it sounds, thanks to a step-by-step simplicity designed for users who need to create something in a hurry or who are new to the world of multimedia. Support for speakers' notes and printing make excellent finishing touches, although potential buyers should note that the program won't print presentation screens to a file (such as .BMP, EPS, or TIFF) that could be used in other applications. Nor can presentations be saved in runtime versions that might be left behind with clients or passed around the office.

MEDIABLITZ!

While MMYP bills itself as a quick-hit presentation maker, MediaBlitz! offers its services as a "multimedia utility." The program's simple design makes its sophisticated multimedia editing tools accessible to any computer user who is comfortable with Windows 3.1.

MediaBlitz! goes beyond the creation of presentations by letting you create libraries of "scores," which are collections of multimedia clips that can be edited and put together in different ways. Rather than using the event-activity link of MMYP, MediaBlitz! uses a time-line metaphor and three separate modules for creating and editing multimedia presentations.

The basic building block in MediaBlitz! is ClipMaker. Each clip references a piece of audio (CD, MIDI, or .WAV) or an animation clip (Autodesk Animator and 3-D Studio, MacroMind Director, and Gold Disk Animation Works are supported). Using the ClipMaker, you create a file that holds related multimedia clips. Each multimedia event can be edited for start and end times, and each can be sampled by means of the



CONNECT: With MMYP, you link events to specific actions, such as clicking a button, to create an interactive presentation.

ics (.BMP, .CGM, .DIB, .DRW, EPS, TIFF, and .WMF formats), and the palette that will be used in the overall design. Changes made to the template occur globally; in order to make changes to individual screens, you will need to create separate presentations and then link them.

After selecting a template,

nied by a sound effect or an animation clip. Multimedia effects can also be linked to buttons, and transition effects (dissolves and wipes, for example) can be assigned to entire screens. Buttons and bullets can call up other screens, other presentations, and even specific screens within presentations. Unlike more sophisticated packages,

First Looks

ClipMaker control panel.

Curiously, MediaBlitz! does not import or use files created with Multimedia Make Your Point. Users who want to use presentation screens created with the MMYP in MediaBlitz! scores will first have to save MMYP screens as bitmaps using a capture utility or experiment with the Windows Clipboard.

The MediaBlitz! clip file can in turn be loaded into the ScoreMaker. A score in MediaBlitz! is a collection of clips, with additional editing tools for integrating those clips along a time line. The time line also provides a means of incorporating bit-mapped images into the score. Each score can be composed of

different clips from different clip files, which makes MediaBlitz! a kind of multimedia storehouse.

It is not always a simple matter to tie all of these elements together into a coherent and professional presentation, but all the tools are here for getting the job done. The interactive time line is especially effective; moving the cursor over the colored bars that represent clip references displays the name of the multimedia element as you define it (instead of "CLAP.WAV," for example, you could name the clip "Light Applause" instead). You double-click on the colored bar to bring up an editing window for making fine adjustments to

each element in the way the presentation is displayed.

For users familiar with Tool-Book programming and Windows DDE, it's possible to create applications that will run a score created with MediaBlitz! This DDE support allows you to create interactive demonstrations for information kiosks or run a multimedia event from within a separate Windows application. For example, a spreadsheet sup-



BLITZ: MediaBlitz! lets you create multiple scores with elements from many sources.

Windows Utilities

HP's Dashboard: Another Way to Drive Windows

BY BARRY SIMON

Small is beautiful. That's clearly the principle that governed the design of Hewlett-Packard's \$99 Dashboard for Windows. Realizing that users want a utility to be unobtrusive when not in use, HP has made Dashboard the most compact control center available to help you drive Windows.

Dashboard squeezes access to a pop-up task list, a clock with alarms, a resource gauge, a print driver manager, some quick launch buttons, help and configure buttons, and access to all your program groups for launching into a horizontal strip that takes up about 20 percent of your screen.

While attractively packaged and implemented, most of Dashboard's features are also found in other Windows utilities. The unique tool is the Printer Manager. Each installed printer is represented by a button on the Dashboard, and each button has what

looks like a small light, with the active printer lit. Changing printers is as easy as pressing a button. For users who need to juggle multiple printers and fax drivers, it's much faster than invoking the Windows printer setup.

Dashboard uses Program Manager's group files directly and, if it is the shell, you can manipulate groups and even make



CONTROL: Dashboard's resource reporter includes information about active tasks.

subgroups. Minimized DOS sessions that have been launched from Dashboard fail to use the icon and title that they would use if launched from Program Manager. What's notable is how little space program launching

takes; groups are indicated with a row of file-folder tabs.

Dashboard implements a virtual desktop the same way hDC's Power Launcher, Abacist's HotWin, and Attitash's Wide Angle do. Your desktop gains a workspace, three, five, seven, or nine screens wide, and you use Dashboard to determine which virtual screen is displayed and to move applications between virtual screens. You can save a set of open programs to particular virtual screens for later use. The lack of hotkeys to switch between virtual screens, something offered by Power Launcher and HotWin, is a drawback.

Dashboard is a welcome addition to the crowded Windows utility market. It competes with Metz Task Manager (First Looks, September 15, 1992) for top honors in the contest to squeeze the most control over Windows into the smallest amount of screen space.

•List price: Dashboard for Windows, Version 1.0, \$99. Requires: 1MB hard disk space, Windows 3.0 or later. Hewlett-Packard Co., PC Software Division, 974 E. Arques Ave., Sunnyvale, CA 94086; 800-554-1305, 408-720-3441; fax, 408-720-3560.

Circle 419 on reader service card

DIFFERENT AUDIENCES

Despite its limitations, Multimedia Make Your Point is a productive tool, and its low price is an encouraging sign for users eager to explore the possibilities of multimedia presentations. For more sophisticated applications and for users more comfortable with programming and production techniques, MediaBlitz! provides all of the necessary tools at an extremely low cost. Even users who have shied away from multimedia will have little excuse for not testing the waters.

•List price: Multimedia Make Your Point, Version 1.0, \$89. Requires: 3MB RAM, 3MB hard disk space, Microsoft Windows 3.1. For CD audio: CD-ROM drive with 150KB transfer rate. Other audio: MCI-compatible sound card, wave audio, or MIDI device.

Circle 420 on reader service card

•List price: MediaBlitz!, Version 1.0, \$95. Requires: 4MB RAM, 2MB hard disk space, Microsoft Windows 3.1. For CD audio: CD-ROM drive with 150KB transfer rate. Other audio: MCI-compatible sound card, wave audio, or MIDI device. Asymetrix, 110 110th Ave. NE, #717, Bellevue, WA 98004; 800-448-6543, 206-462-0501; fax, 206-454-0672.

Circle 421 on reader service card

Borland's Why it's smart

The #1-selling database

dBASE® is the #1-selling relational database in the world. It offers the most complete set of tools for developers and users to access and manage their corporate data.

Today, more than three million people use it to build applications that help them run their businesses and maintain a competitive edge. And with the world's largest community of trainers, consultants, and add-on software extensions, it's little wonder that dBASE is the standard for corporate applications development. Now, new dBASE IV version 1.5 makes it smarter than ever to go with #1.

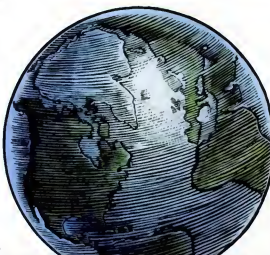
New! Version 1.5 is here

Now there's an easier-to-use, faster, and more powerful dBASE. It's packed with the features you've asked for most, making it smarter than ever to use the world's #1 PC database.

Working smarter is faster

OPTIMIZATION
IQ!
TECHNOLOGY

With new dBASE IV, you get the job done faster because you work smarter. Smarter because new IQ!™ optimization technology



The Worldwide Standard

What's new in dBASE IV v1.5:

For Users

- Mouse support
- Editable multi-file view
- Calculated field linking
- QBE summary operators and pick lists
- Automatic install
- New optimization technology—IQ!
- Save query indexes

For Developers

- INDEX functions
- 40 work areas
- Template Language included
- Enhanced BLANK support
- Browse/Edit organize menu toggle
- Conditional compilation
- Low-level file I/O
- Open architecture Control Center
- Enhanced RUN function
- Multiple and global procedure libraries

automatically selects the fastest method to retrieve your data. Smarter because you can create tables, forms, reports, queries, and menus in record time—without programming.

Smarter because you get 40 different work areas for easier management of large applications. Plus mouse support for fingertip access to features, an enhanced RUN function to run popular DOS applications from within dBASE, and comprehensive multi-user capabilities. All of which means you maintain tight data integrity, more flexibility and more support than ever before.

Advanced design tools build applications faster

dBASE IV's easy-to-use Control Center comes complete with an innovative set of design tools, including report, form, and label generators that help you create your applications quicker. And the Control Center's open architecture makes it easy to enhance or customize your own applications by incorporating third-party add-on products available for dBASE.



dBASE IV[®] er to go with #1

Faster applications development

The industry-standard dBASE language comes with a host of improvements that speed development:

- Integrated debugger and a built-in applications generator
- More than 40 new commands, functions, and keywords—Template Language now included
- C language-like low-level file I/O
- IBM[®] SAA-compliant SQL
- Advanced BLANK support

100% commitment to dBASE

Now that it's from Borland, your investment in dBASE is secure. dBASE gives you all the benefits of complete compatibility and application portability that come with the database standard. And Borland is the acknowledged database technology innovator, so you're on the winning team for the long haul. Get dBASE IV v1.5 today. You'll see why it's smarter than ever to go with #1.



Get NEW dBASE IV v1.5 today and receive more than \$250 in additional software,



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Send me my FREE Pro Pack Software!

Purchase dBASE IV v1.5 and Borland will give you Central Point Software's Backup and Anti-Virus programs *free*.^{*} That's a suggested retail value of \$259. Offer good while supplies last.

Check DOS disk size required: ☐ 5 1/4" ☐ 3 1/2"

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BORLAND

dBASE IV from Ashton-Tate[®], a Borland Company

CIRCLE 285 ON READER SERVICE CARD

■ Groupware

Microsoft Adds Scheduling To Its E-Mail System

BY HENRY FRESKO-WEISS

With Schedule+, Microsoft has made personal and group scheduling about as easy as it can get. Creating personal appointments takes just seconds, and group scheduling is intelligent and in many ways automatic. The program runs under Microsoft Mail, so if you're already using that system, Schedule+ is a valuable addition.

The main screen in Schedule+ is the Appointment Book, a daily calendar with half-hour time slots, a month-at-a-glance calendar, a notes area, and tabs for accessing other views. The only other work screen is the Messages window, which holds all the mail related to meeting requests and responses.

You can't change the half-hour time slots on the calendar, but you can record alternative start and end times for an appointment, down to the minute.

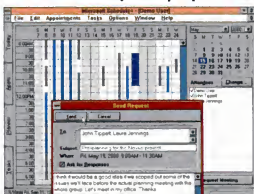
APPOINTMENTS AT A CLICK

You enter an appointment by simply pointing at a start time, dragging down to the end time, and immediately typing a description—there's no dialog box. For it to be any easier, the program would have to read your mind. You can add, delete, or change an appointment description right on the calendar, drag the appointment to a new time, or push and pull the end border to change its length. A time slot can hold up to six simultaneous meetings.

Double-clicking on an appointment brings up a dialog box that lets you change appointment particulars. The dialog box also lets you set a reminder, mark an appointment private, invite other people, or make an appointment tentative. Tentative meetings don't show

up as busy time in the Planner view, and they can't be seen by other users setting up a group meeting.

From the Appointments menu, Schedule+ lets you set up



GET TOGETHER: Schedule+ makes it easy to arrange meetings and personal schedules.

recurring appointments. You can make them daily appointments or define them as weekly, biweekly, monthly, or yearly on a particular day of the week. Unfortunately, you can't specify other patterns, such as every third week or every ten days.

A LONGER VIEW

The Planner view lets you see up to 17 days at once. It shows the time slots with columns for the days. Your busy times are indicated by a vertical bar. If you use the Appointments menu to set up a meeting, you're returned to the Planner view; if you double-click a time cell, you're brought to the corresponding place in the appointment book. By dragging the pointer over more than one column, you automatically establish a multiple-day appointment.

Another view in Schedule+, Tasks, lets you work outside the calendar. Here you set up project headings with tasks listed under them. Each task can have a priority, a due date, and a description, and you can sort on

any one of the fields. Tasks can have reminders, and a button lets you put them in your schedule. Overdue tasks appear in red; the description of completed tasks automatically appears in the notes field for that day.

Your tasks can be shared as easily as your personal calendar, making it possible to do simplified workflow management for a group.

GROUP SCHEDULING

The Planner view is where you do your group scheduling. There you'll find a Change button that lets you select attendees from a list of Schedule+ users. The list can include conference rooms, projection equipment, and other resources. All of their busy times are collated and represented by vertical bars. When your appointments overlap with those of your attendees, the program lets you know by cross-hatching the bars.

Since all the busy times are clearly displayed, it becomes a simple matter to see when the people you want at a meeting are free. You can also use the Auto-Pick feature to find the first free time. After selecting your time, you click the Request Meeting button and a message form pops up. All you need to enter is a subject line and description. When you click the Send button, each person on your list gets the message, and Schedule+ automatically books the appointment on your calendar. If an attendee isn't using Schedule+, he or she will still get a Microsoft Mail message. This

makes it possible for an organization to make effective use of Schedule+ even if everyone isn't using the program.

Attendees receiving a request can accept, reject, or tentatively accept it. Their responses are automatically sent back to you, and their calendars are updated.

Schedule+ allows for five levels of security. You can open your calendar up completely—let other people view it, add appointments, and even change existing appointments—or you can restrict access to just viewing your free and busy times. Schedule+ data can be shared across servers and over a wide area network. There is also a gateway to PROFS users, and schedule reconciliation lets you work on your schedule off-line.

Schedule+ makes individual and group calendar maintenance a breeze. Its features are intuitive and often automated. The one main drawback right now is that it will only work with Microsoft Mail. But Microsoft says that Version 2.0 will run with any Windows mail application that supports the company's mail protocols. □

FACT FILE

Microsoft Schedule+ for Windows, Version 1.0

Microsoft Corp., One
Microsoft Way, Redmond, WA
98052; 800-426-9400,
206-882-8080

List price: Server and workstation software with two-workstation license, \$195; additional five-user license, \$395; 20-user, \$1,349; 100-user, \$5,500; 500-user, \$22,500.

Requires: ZMB RAM, Microsoft Windows 3.0 or later, Microsoft Mail 3.0, networking software compatible with DOS 3.1 or later.

In short: Schedule+ is an easy program to use and learn. It takes only seconds to set up appointments, and scheduling is intuitive and automatic wherever possible. But you must be a Microsoft Mail user to run the program.

ON READER SERVICE CARD

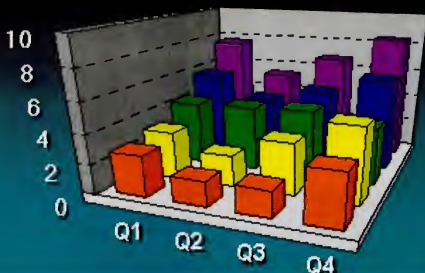
The most advanced Windows spreadsheet starts with an elementary concept



Introducing Quattro® Pro for Windows.

B O R L A N D

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...Spreadsheet

Quattro Pro for Windows is the most usable spreadsheet ever made. Built with Borland's renowned object-oriented technology, Quattro Pro for Windows* is packed with hot new features you won't find in any other spreadsheet.

NEW! Spreadsheet Notebooks* with customizable Tabs are nothing less than a revolution in spreadsheet ease of use. Now you can intuitively organize and manage your spreadsheet data.

NEW! Object Inspector™ menus end the hassle of searching through menus. They're simpler than 1-2-3. Just click the right mouse button anywhere on the screen to get a list of what you can change and change it right there.

NEW! Database Desktop is the easiest way to incorporate dBASE® and Paradox® data into your spreadsheet. Just what you'd expect from Borland, the leader in database technology.

NEW! SpeedFill™ and **SpeedFormat™** slash setup time by automatically filling in spreadsheet headings and formats.

NEW! SpeedBars™ are context-sensitive and customizable. SpeedBar icons give you pushbutton access to your most frequently used commands.

NEW! Presentation Graphics and drawing tools that rival those of Freelance and Harvard Graphics are built-in. You don't need to buy a separate graphics package.

YES! Compatible with Lotus 1-2-3 files, macros, and publishing styles and with Excel .XLS files.

Find your spreadsheet information in a flash!

From everyday tasks to complex projects, Spreadsheet Notebooks are the easiest way to work with your spreadsheets. By incorporating multiple spreadsheet pages in a single file (one notebook can handle

up to 256 spreadsheet pages), you can break any complex spreadsheet into easy-to-manage pieces.

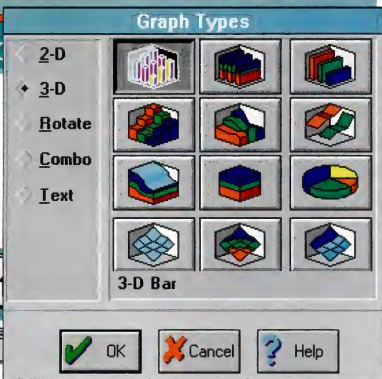
Assign meaningful names to your notebook tabs and finding information is as easy as flipping through a notebook.



Notebooks are the smart way to do 3-D spreadsheets! You can present data in flip-chart style and format pages in a group, like chapters. Because you navigate easily, it's simple to build multi-page models.

r Totals 7.1 4.6 6.5 10.2 28.4

Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total
America	7.6	5.7	4.3	3.2
Asia	5.7	4.3	3.2	2.8
Europe	4.3	3.2	2.8	2.1
North America	3.2	2.8	2.1	1.9
South America	2.8	2.1	1.9	1.7
Global Totals	23.6	19.5	17.3	15.7



Notebooks

You may never open the manual

Quattro Pro for Windows is the most usable spreadsheet ever. With Quattro Pro for Windows' object-oriented user interface, every action you take is easier and faster.



Object Inspector menus let you make one-step changes to any object on your screen with just a click of the *right* mouse button—no more searching through layers of pull-down menus.

Context-sensitive, customizable **SpeedBars™** give you pushbutton access to your frequently used commands.

Drag and Drop lets you move or copy data instantly with the mouse.

Built-in graphics rival standalone packages

Quattro Pro for Windows gives you extraordinarily powerful graphics tools *built-in*. You'll never have to learn a separate graphics package.

Get 35 2-D and 3-D graph types—with thousands of variations. Then enhance your graphs by adding text, lines, arrows, and built-in clip art.

Use the **Slide Show** and **Light Table** to create incredible electronic presentations. Arrange and rearrange slide shows in seconds and customize them with dazzling transition effects.

You can create 35mm slides and overheads, too. No other spreadsheet gives you all this presentation power.

*Quattro Pro for Windows and Spreadsheet Notebooks have patents pending.

Notebooks

Object Inspector

Database Access

1-2-3 Compatibility

Windows Offer

Quattro Pro beats

Other spreadsheets don't compare

FEATURE	QPW	EXCEL 4.0	1-2-3/W R1.1	1-2-3 R2.4	1-2-3 R3.1
ORGANIZATION					
Spreadsheet Notebooks	Y	N	N	N	N
Nameable Tabs	Y	N	N	N	N
Group Formatting on Selected Pages	Y	Y	N	N	N
True 3-D Consolidation	Y	N	Y	N	Y
EASE OF USE					
Right Mouse Button Formatting	Y	Y	N	N	N
Object Inspectors	Y	N	N	N	N
Context-sensitive SpeedBars	Y	Y	Y	N	N
SpeedFill and SpeedFormat	Y	Y	Y*	N	N
Drag and Drop	Y	Y	N	N	N
GRAPHICS AND PRESENTATIONS					
3-D Graphs	Y	Y	N	N	N
Slide Show with Light Table	Y	N	N	N	N
Live Linked Graph Types and Formatting in Slide Shows	Y	N	N	N	N
DATABASE ACCESS					
Live View of Networked Database Tables	Y	N	N	N	N
Database Desktop	Y	N	N	N	N
CUSTOMIZATION					
Macro Buttons on Spreadsheet	Y	Y	N	N	N
Visual User Interface Builder	Y	N	N	N	N
COMPATIBILITY					
Reads Quattro Pro, Excel, 1-2-3 Files and Styles (including Allways & Impress)	Y	N	N	N	N
Runs Your QPro & 1-2-3 Macros!	Y	N	N	N	N
ANALYSIS					
Optimizer	Y	Y	Y	N	Y

*Requires add-in.

†Some 1-2-3 macros may require modification.

Outstanding 1-2-3 and Excel compatibility

Quattro Pro for Windows is the next-generation Windows spreadsheet. It is the *only* spreadsheet that gives you both innovation *and* compatibility with Lotus 1-2-3, Excel, and Quattro Pro. Quattro Pro for

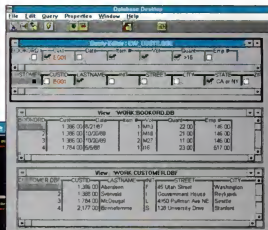
Windows supports 1-2-3 files, macros, and publishing styles, including

Allways, Impress, and WYSIWYG. It also supports Excel XLS 3.0 and 4.0 files. What's more, Quattro Pro for

Windows is much more compatible with 1-2-3 than Excel. For example, unlike Excel, Quattro Pro formulas, ranges, and command actions (like moving blocks) work as 1-2-3 users would expect.

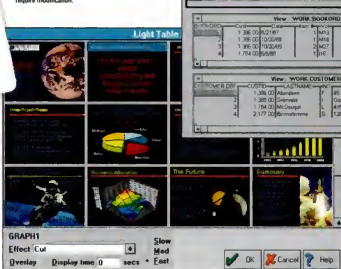
Fast database access to dBASE and Paradox

Only Quattro Pro for Windows gives you easy access to database information. Borland's unique Database Desktop™ lets you view, edit, and copy dBASE and Paradox tables *directly* from within Quattro Pro. And *only* Quattro Pro for



▲ The Database Desktop: *Only* Borland makes access to dBASE and Paradox data this easy with QBE.

Only Quattro Pro for Windows gives you a Light Table to arrange your electronic slide shows in seconds.



1-2-3 and Excel!

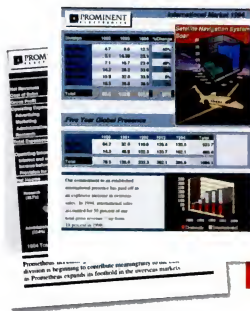
Windows has Query By Example, so you can ask questions about your data with point-and-click ease. Since it's from Borland, the database leader, you can count on it working right, even in network environments.

Create custom applications in minutes

Because of its object-oriented design, *only* Quattro Pro for Windows makes it easy to customize your spreadsheet. All the tools are there for you to create your own custom dialog boxes, powerful time-saving macros, and SpeedBars.

Don't settle for second best

Independent tests conducted by Usability Sciences Corporation find that two out of three Windows spreadsheet users tested preferred Quattro Pro for Windows. Don't settle for second best—get Borland's Quattro Pro for Windows today!



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Quattro Pro for Windows and DOS now together for the price of one!

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Buy Quattro Pro WinDOS because it's the hands-down best Windows spreadsheet, and get the top DOS spreadsheet FREE! Or buy Quattro Pro WinDOS because it's the absolute best DOS spreadsheet, and move to Windows at your own pace—your Windows spreadsheet is already bought and paid for.

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FOR WINDOWS

FOR DOS

W i n D O S



QUATTRO PRO FOR WINDOWS
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QUATTRO PRO FOR DOS
BORLAND

"Quattro Pro for Windows is [what] Lotus should have released, but didn't."

InfoWorld

"Quattro Pro 4.0 [is] the ultimate DOS spreadsheet."

PC Magazine



B O R L A N D

Software Craftsmanship

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CIRCLE 287 ON READER SERVICE CARD

Notebooks

Object Inspector

Database Access

1-2-3 Compatibility

Windows Offer

New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Emerson Andrew Torgan

NEW

DEC Dives Into the Low-End PC Arena with DECpc LP Line

Digital Equipment Corp. is gearing up to go head-to-head with Compaq and Dell in the battle to sell low-cost PCs. The DECpc LP (Low Profile) line consists of six systems, five of which are upgradable. They range in processor size and price from the 33-MHz 386SX-based DECpc 333sx LP (\$899) to the 66-MHz 486DX2-based DECpc 466d2 LP (\$2,199), not including a color monitor. The line also includes the 40-MHz 386DX-based DECpc 340dx LP, the 25-MHz 486SX-based DECpc 425sx LP, the 33-MHz 486DX-based DECpc 433dx LP, and the 50-MHz 486DX2-based DECpc 450d2 LP.



The \$1,999 DECpc 450d2 LP.

The 333sx, the only member of the line that is not upgradable, ships with 2MB RAM, a 52MB hard disk, DOS 5.0, and Windows 3.1. The five other systems ship with 4MB RAM and a 122MB hard disk and are upgradable via a snap-in daughtercard for replacement of processor and cache. The LP systems also feature local-bus Super VGA and a dedicated graphics accelerator chip on the motherboard, and 512K (expandable to 1MB) of two-port VRAM.

DEC has also announced a new global business strategy, under which DEC Taiwan will manufacture and ship separate PC components to seven worldwide Integration Centers for assembly. Each center will assemble the systems in a standardized manner.

•List price: DECpc 333sx LP, \$899; DECpc 340dx LP, \$1,549; DECpc 425sx LP, \$1,649; DECpc 433dx LP, \$1,849; DECpc 450d2 LP, \$1,999; DECpc 466d2 LP, \$2,199. Digital Equipment Corp., 146 Main St., Maynard, MA 01754; 800-722-9332; fax, 508-486-6422.

Circle 402 on reader service card

HOT
PROSPECT



DOC•IT: The All-in-One Fax, Scanner, Printer and Copier

Okidata is breaking into the desktop document processing market with a unique peripheral that is truly a "jack of all trades." DOC•IT, a single desktop unit that measures 8.5 by 17.5 by 22.5 inches (HWD), combines an 8-page-per-minute printer that supports PCL, Epson LQ, and TrueImage emulations; a Group 3-compatible plain paper fax machine; a sheet-fed or hand-held scanner; and a copier.

Designed for use under both DOS and Windows, the DOC•IT system consists of three elements: the desktop document processor, a controller board, and DDP management software. The document processor is based on Okidata's own LED (light emitting diode) print engine for printing and "walk up" copying. An image engine is also incorporated for scanning and faxing documents. The image engine is removable for use as a hand scanner.

The DOC•IT Manager is a GUI software application that controls the four integrated document processing functions. The software offers pull-down menus, dialog boxes, and icons. DOC•IT is available in both 300-dot-per-inch (DOC•IT 3000) and 400-dpi (DOC•IT 4000) models.

•List price: DOC•IT 3000, \$3,999; DOC•IT 4000, \$4,999. Okidata, 532 Fellowship Rd., Mount Laurel, NJ 08054; 800-654-3282, 609-235-2600.

Circle 401 on reader service card

NEW

They're Printers, and They're From Compaq—Yes, Compaq

Don't worry. You haven't gone batty. The new kid on the block is **Compaq**, making its foray into the laser printer arena with the network-ready 20-page-per-minute Pagemarq 20 and the 15-ppm Pagemarq 15. Both printers are based on a Fuji Xerox laser engine and use AMD 29000 RISC controllers. The units feature PostScript Level 2 and PCL 5 emulation and connect directly to Novell and Apple networks. Up to five interfaces can be active at the same time. Direct connectivity is supported via Ethernet, Token-Ring, and AppleTalk interfaces, according to Compaq.

The Pagemarq 20's controller runs at 20 MHz, and the unit includes a 128K cache. The Pagemarq 15's controller runs at 16 MHz. Both units provide a 300- by 300-dot-per-inch resolution standard, a maximum resolution of 800- by 400, 43 scalable and 7 fixed resident fonts, and support for 8.5- by 11-inch and 11- by 17-inch paper. The Pagemarq 20 has a paper capacity of up to 1,500 sheets.

•List price: Pagemarq 20, \$5,499; Pagemarq 15, \$3,999. Compaq Computer Corp., Customer Support Center, P.O. Box 69-2000, Mail Drop 120208, Houston, TX 77269; 800-345-1518.

Circle 403 on reader service card

NEW

ALR Expands Line of Notebook PCs with 486SX Color Ranger

Advance Logic Research's ALR Ranger MC4SX/20 is a 20-MHz 486SX-based notebook PC with a 9-inch passive-matrix color display that has 640- by 480 resolution. It is upgradable to a 25-MHz 486DX through a CPU module that lets you install the faster processor. The 7.5-pound unit comes standard with three internal slots for CPU upgrades, RAM upgrades (to a maximum of 16MB RAM), and I/O expansion for optional SCSI, fax/modem, and external hard disks, or CD-ROM and tape drives.

The ALR Ranger MC4SX/20 is available in two models: a \$2,949 model that comes with 4MB RAM and an 80MB hard disk, and a \$3,249 model that comes with 4MB RAM and a 120MB hard disk. Both models include power

management features, including an ALR PowerPLUS battery and SmartSource power supply, and ALR Advanced Control Software Utility Interface, a pop-up battery-life menu.

•List price: **ALR Ranger MC4SX/20** (80MB hard disk drive), \$2,949; **ALR Ranger MC4SX/20** (120MB hard disk model), \$3,249. **Advance Logic Research Inc.**, 9401 Jeronimo, Irvine, CA 92718; 800-444-4257, 714-581-6770; fax, 714-581-9240.

Circle 404 on reader service card

NEW

3Com Unveils New Approach to Parallel Network Processing

3Com's latest line of Ethernet network adapter cards, the EtherLink III family, is based on an application-specific integrated circuit (ASIC) developed by the company. According to 3Com, the new technology, called Parallel Tasking, speeds data transfers by allowing separate tasks to be performed in parallel, leading to an increase in adapter efficiency and performance.

The first of the EtherLink III family to ship is a 16-bit ISA adapter that is designed to "sense" what type of PC it is installed in (for example, a 386 or a 486) and automatically optimize its drivers to suit the processor. 3Com plans to ship 32-bit EISA and 32-bit Micro Channel adapters in the near future.

•List price: **EtherLink III 16-bit ISA adapter**, \$199; five pack, \$910 (\$182 each). **3Com Corp.**, P.O. Box 58145, 5400 Bayfront Plaza, Santa Clara, CA 95052; 800-638-3266, 408-764-5000; fax, 408-764-5001.

Circle 405 on reader service card

NEW

UltraFAX Provides OCR and Image-Processing Capabilities

The highly competitive Windows fax software market has a new player: **UltraFAX**, Version 1.0, from **ZSoft**. Priced at \$119, **UltraFAX's** OCR capabilities let you read incoming faxes and create editable text files for use with Windows applications, such as word processors and spreadsheets. It comes with a complete set of drawing, editing, and text annotation tools that let you view a fax, add comments, and forward the document without ever making a hard copy.

The package provides image processing capabilities, such as anti-aliasing, that automatically clean up dirty faxes and improve on-screen readability. A multiple-document viewer offers drag-and-drop page rearrangement and merging, document viewing at zoom

BRIEFS

PIMS AND CONTACT MANAGERS

Day Runner's Time Plus, Version 1.0 (\$60), is a PIM (Personal Information Manager) that prints pages for the company's Personal Organizer book. Time Plus features a pop-up calendar, an address and phone book with auto-dial capabilities, an interactive database with to-do lists and notes, and printing options that include phone lists, schedules, rotary cards, and labels. 800-232-9786, 714-680-3500; fax, 714-680-0542.

International Solutions is shipping **Impulse!** Professional, Version 2.6 (\$295 for a network-ready, single node package), featuring a new pull-down menu structure. Most features also have a hotkey option to give experienced users single key access. The program has an enhanced log-book-scheduler option that tracks client communications by date, purpose, and results of call or meeting. A new memory resident/swap-out option lets you swap between **Impulse!** Professional and other applications. 617-575-0290; fax, 617-575-0735.

Prisma Software's cardfile for Windows 3.1, **Names, Notes, and Numbers**, Version 1.0 (\$59), provides the following features: field names and data in separate edit boxes on the face of each card, multiple fonts for the field names and data, hidden field names, a customizable button bar, the ability to tab from field to field, automatic reindexing, a phone directory module, auto-dialing, and Dynamic Data Exchange (DDE) for applications that support DDE. 800-373-0241; fax, 319-266-2522.

Pyramid Data's **PowerLeads!** for Windows, Version 1.0 (\$295), provides auto-dialing, mail-merge to Ami Pro and Word for Windows via Dynamic Data Exchange, expense management, and a mailing label generator. The package tracks up to 1 million contacts and has customizable fields and check boxes for such data as priority, rating, and sales status. 800-972-7972.



UltraFax lets you put notes on faxes.

levels from 10 to 600 percent, and single page, dual page, or multipage thumbnail views. A document manager uses drag-and-drop to archive, organize, retrieve, and transmit multiple faxes and data files. **UltraFAX** supports a wide variety of flatbed, sheet-fed, and hand scanners, as well as most fax boards based on the Intel DCA/CAS Class 1 and Class 2 communications standards.

•List price: **UltraFAX**, Version 1.0, \$119. **ZSoft Corp.**, 450 Franklin Rd., #100, Marietta, GA 30067; 404-428-0008; fax, 404-427-1150.

Circle 406 on reader service card

IMPROVED

LAN Version of Arago: Low Price, Unlimited Users

WordTech Systems is shipping low-priced multiuser versions of its dBASE IV-compatible **Arago** line of database management software. The **Arago dBLX/LAN** package is priced at \$999 for an unlimited number of users on a network. Now in Version 2.5, the updated **Arago** line has 23 new functions and 13 new commands, including 10 array functions and enhancements that make the **Arago** syntax more compatible with dBASE IV 1.5.

The new multiuser versions also have a new optimization technique that promises to improve LAN performance. The technique, called **ESP** (Exclusivity Simulation Protocol), allows shared data files to be processed at speeds normally available only in exclusive mode, when other users cannot read the data. The line consists of **Arago dBLX**, a dBASE IV-compatible interactive environment; **Arago dBLX/LAN**, the multiuser version; **Arago Quicksilver**, an .EXE compiler (also multiuser); and **Arago Professional**, a developer's package.

•List price: **Arago dBLX/LAN**, \$999; **Arago Quicksilver**, \$799; **Arago Professional**, \$1,199. **WordTech Systems Inc.**, 21 Altarinda Rd., Orinda, CA 94563; 800-228-3295, 510-254-0900; fax, 510-254-0288.

Circle 407 on reader service card

NEW

Mustek Ships PrinScan 105 Adapter and Scanner Bundle

Mustek is offering a hand-scanner solution for both notebook PC users and users with no open slots in their desktop systems. The PrinScan 105 scanner adapter system plugs into the parallel port of any notebook or desktop PC and requires no internal interface card. The adapter unit also facilitates the sharing of one scanner between several computers and eliminates the need to constantly remove and reinstall an interface card.

The PrinScan 105 is bundled with Mustek's Matador 105 gray-scale hand scanner, ScanKit Gray utility software, and Perceive Personal OCR (optical character recognition) software. Current owners of Mustek's Matador 105 and M-105 scanners can buy an optional \$149 package containing the PrinScan 105 adapter, ScanKit Gray, and Perceive Personal OCR software.

•List price: *PrinScan 105*, \$299. *Mustek Inc.*, 15225 Alton Pkwy., Irvine, CA 92718; 800-366-4620, 714-833-7740; fax, 714-833-7813.

Circle 408 on reader service card

IMPROVED

Landmark Upgrades Three \$99 PC Diagnostic Packages

Landmark Research International's update of PC Probe, Version 3.0, performs up to 150 diagnostic tests on a PC, including system information, benchmark testing, and virus scanning. It also displays what is being tested in annotated 16-color .PCX graphical images. Other features included in the package are password protection against destructive operations, Super VGA video mode tests, and an AT CMOS editor.

PC Certify, Version 4.2, is designed for nontechnical users and provides a suite of diagnostic tests and system information. PC Certify can be set to run on automatic mode, displaying test results on-screen or in printed form to be faxed to technical support.

DiskBase, Version 4.0, is Landmark's upgrade of its hard disk drive technical specification software, which reveals 12 technical specifications on over 2,500 hard disks and 8 technical specifications on over 220 controllers. It provides hard disk setup information for 24 different BIOS versions, and can aid in resolving address problems when mixing controllers by determining the DEBUG address using its Controller Database.

•List price: *PC Probe*, Version 3.0, \$99; *PC Cer-*

BRIEFS

PIMS AND CONTACT MANAGERS

Valmer is shipping 357 (\$99), a Windows-based contact management software package. 357 includes activity scheduling, to-do lists, a daily calendar, mail-merge capabilities, multiple sort fields, and auto-dialing features. 415-328-1357; fax, 415-321-5597.

ACCOUNTING AND FINANCE

EDMS's Q-Trax (\$49.95) investment management software provides stock and bond analysis, portfolio management, and uploading of stock and bond data from on-line services. Q-Trax offers a number of graphing tools that let you plot stock and bond price data along with indicators and comparisons. The portfolio management portion of the program tracks up to 30 accounts and over 7,000 transactions. 800-395-7670.

M-USA's CashBIZ for Windows (\$49.95) contains a designated chart of accounts for home use and for the small business person, with accounts receivable/payable capabilities and access to financial reports. CashBIZ imports Quicken files, uses Quicken checks, exports to spreadsheet, database, presentation graphics, word processor, or tax preparation software programs, supports taxable or nontaxable customers or services, and prints on either laser or continuous forms. 214-368-6100; fax, 214-404-1957.

Parson Technology's MoneyCounts 7.0 Personal Edition (\$49) sports a checkbook-like entry screen. The program manages cash, checking, savings, credit cards, and handles investments. It prints over 25 reports as well as pie, bar or line graphs. 800-223-6925.

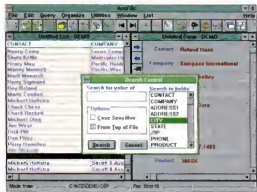
Spreadware has unveiled Beyond Breakeven (\$289), a profitability analysis program for use with Excel 4.0. Beyond Breakeven lets you compare up to ten different models, and

tify, Version 4.2, \$99; DiskBase, Version 4.0, \$99. *Landmark Research International Corp.*, 703 Grand Central St., Clearwater, FL 34616; 800-683-6696, 813-443-1331; fax, 813-443-6603. Circle 409 on reader service card

IMPROVED

AceFile Gains Toolbar, Bitmap Graphics Support

Ace Software's update to its flat-file database, AceFile, Version 2.0, features new relational capabilities via three new commands: Relate, Append, and Join. The Relate command lets you link two or more databases in a one-to-one relationship. The Append command lets you select fields and records from multiple databases and combine them into one database. The Join command lets you maintain separate databases, but produce multifile reports by joining the two databases into a third; perform a crosstab analysis; and generate a report. It also has a new toolbar that lets you invoke the most commonly used functions by clicking on the appropriate icon. Placing the mouse cursor over an icon brings up the description of the function in the status line at the bottom of the screen. Bitmap graphics can now be included in all of the reports, labels, and forms generated by the program. Images can be scanned in or imported from other applications



AceFile has easy search facilities.

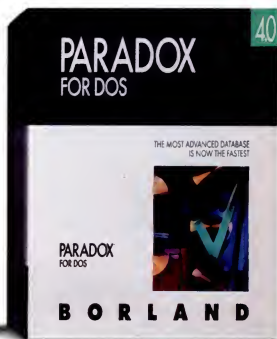
in .BMP, .PCX, or TIFF format. The on-line reference serves as context-sensitive help.

AceFile 2.0 also has an enhanced telephone dialer that can be set up to automatically dial local and long-distance numbers directly or in a PBX. Support for long-distance carriers and other codes is now user-programmable. It also ships with a number of business templates, including templates for Order Entry/Inventory, Checkbook/Payables, and Employee Records. •List price: *AceFile 2.0*, \$199, upgrade from previous version, \$49. *Ace Software Corp.*, 1740 Technology Dr., #680, San Jose, CA 95110; 800-345-3223, 408-451-0100; fax, 408-437-1018. Circle 410 on reader service card

DEMAND PERFORMANCE

Introducing Paradox 4.0 for DOS

*The most
advanced database
is now the fastest*



DEMAND



Paradox is fastest

NSTL results prove new Paradox® 4.0 is the world's fastest relational database! Thanks to Borland's new WarpSpeed™ performance, Paradox 4.0 sets the standard in performance for both network and standalone use. For you, this means faster answers to queries, faster memory access and faster multiuser applications.

In fact, Paradox 4.0 gives you unparalleled performance throughout all aspects of database management and application development. As NSTL put it, "Paradox is clearly the best all-around product evaluated." It beats FoxPro hands down.



Software Digest's NSTL report rates Paradox highest of all databases tested in Overall Power and Performance.

New Windows-like interface

Our new Windows-like interface makes using Paradox 4.0 more intuitive than any other database. Context-sensitive SpeedBar™ controls give you instant access to your frequently used commands and features. Movable, resizable windows, pull-down menus and mouse support make creating and editing your database simple. And new dialog boxes give you the choices you need in one place, saving time and effort.

The fastest way to get an answer

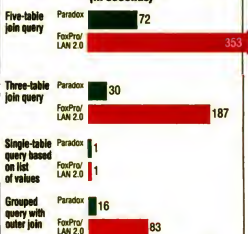
Paradox pioneered Query By Example (QBE), the easiest way to get answers from your database. Now, a built-in query optimizer enhances QBE, automatically finding the fastest path to the answers you're seeking. Plus, multi-table forms and reports make everything from data entry to presentations a snap—all without programming.

WarpSpeed

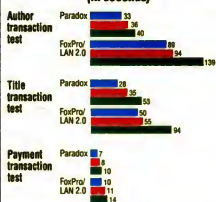
WarpSpeed stands for Wildly Accelerated Relational Performance. It reflects Borland's commitment to performance, and is also an integral part of our dBASE® and InterBase™ development programs.

NSTL tests confirm Paradox 4.0: Quicker than a Fox

Single-user performance tests (in seconds)



Multiuser performance tests (in seconds)



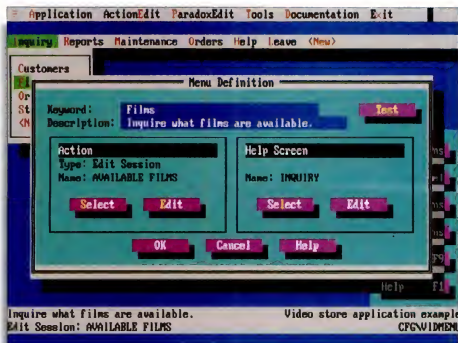
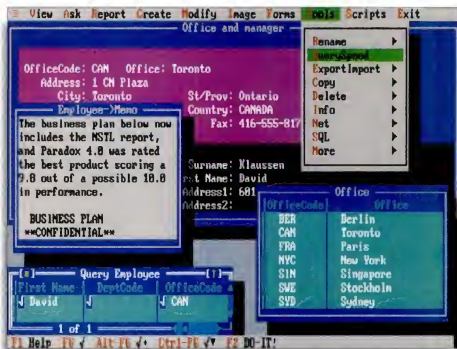
Multiuser Legend:

1 station ■ 3 stations ■ 8 stations ■
To test the speed of transaction performance, NSTL designed a database for book order entry. Each record contained an author, a title, an ISBN number, a price and inventory information. The database contained 25,000 books and 5,000 authors.

PARADOX

New memo fields

Paradox 4.0 gives you the power to manipulate data you couldn't manage with ordinary databases. With new variable length memo fields, you have the ability to effortlessly manage large amounts of text information throughout your applications. And you can store anything you want in the new binary field—word processor documents, sound, bitmapped graphics, multimedia data—and then manipulate it under program control. Each can hold up to 256Mb of data per field—up to 4 gigabytes per table! There's no easier way to manage large applications.



◀ With the new Applications Workshop, you can build complete applications that include pull-down menus, mouse support, transparent multiuser edit sessions and more. Best of all, it's simple!

Efficient memory management

Paradox 4.0 gives you the best way to manage memory. VROOMM™ with Turbo Drive™ provides more available memory and more efficient memory utilization. So Paradox 4.0 runs on any 286 PC or above. In addition, Paradox 4.0 can run as a DOS application under the Microsoft® Windows operating environment, thanks to complete DPMI support.

DEMAND

The most award-winning database

Since its introduction, Paradox has won more awards for technical excellence and customer satisfaction than *any* other database. Awards from every major computer magazine and periodical from around the world. In fact, in a recent survey by *ComputerWorld*, Information Systems professionals ranked Paradox as having the best technology, best documentation, best service and support and best price performance. All of which have made Paradox the favorite of users and developers alike.



May 1991
Paradox 3.5

Faster network performance

Paradox 4.0 is the fastest multiuser network PC database ever. And it's network-ready right out of the box. Multiple users can read, write and modify data simultaneously. You get all this, plus new automatic group lock security that allows multiple users to share data flexibly, providing dramatically increased performance. Just another reason Paradox 4.0 is the best investment for your business.

Transparent access to SQL data

With Paradox SQL Link (sold separately), you can seamlessly access remote SQL data. You can then work with this data using standard Paradox features such as Query By Example. Paradox does all the translation for you.

Paradox SQL Link completely shields you from the intricacies of PC and database server communications. When you specify an SQL table operation, Paradox SQL Link automatically selects the correct communications protocol, opens up

Paradox Developer's Corner

Powerful, procedural language

The Paradox Application Language (PAL™) lets you create sophisticated Paradox applications quickly. PAL procedures allow for private and global variables, array passing and variable scoping. Paradox 4.0 includes more than 90 new commands and functions.

Powerful UI controls

Easily construct your applications with a robust look and feel using the built-in UI controls: non-modal pull-down menus, dialog boxes (with push buttons, check boxes, radio buttons, pick lists, type-in lines and more), pop-up menus, mouse support and multiple overlapping windows.

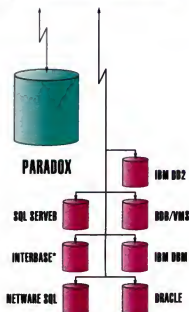
Event-driven extensions

GetEvent() passes keyboard, mouse and/or system events into your procedures for dispatching. Use dynamic arrays to pass dynamically created data structures to procedures. This greatly increases the modularity and reusability of your code.

Leverage Paradox behavior

Build on Paradox's multiuser support for automatic locking, multi-table forms and referential integrity. Define special error-handling procedures to trap and process error conditions, giving you complete flexibility over users' interaction with your custom application.

BORLAND



Paradox SQL Link supports more industry-standard database servers than any other PC database available. (*And the InterBase SQL connection will be available soon.)

a communication link, relays statements to the database server and presents the results of your query.

By using Paradox SQL Link, you can now enjoy the benefits of SQL databases without the difficulty of mastering the SQL programming language. In addition, Paradox SQL Link operations follow database server security restrictions.

Borland—the database leader

Borland is the acknowledged leader in PC relational databases. More users and developers trust their data to Borland products than any other company. And an integral part of that trust is Paradox.

Paradox 4.0's power to create and manage sophisticated applications, maintain data integrity, handle large quantities of data, perform complex database operations and connect to corporate data is critical to the success of a database management system today. No other PC database meets this challenge like Paradox 4.0—the most advanced database. Best of all, with Paradox 4.0's 60-day, money-back

guarantee, you can order risk-free today. So demand the best. Demand Paradox!



**To upgrade or
order, see your
dealer or call
1-800-331-0877,
ext. 5856 today!**

**Canadian customers call
1-800-461-3327.**

B O R L A N D

Software Craftsmanship

CIRCLE 220 ON READER SERVICE CARD

NEW

NCR Unveils Software-Based Disk Array

NCR's Disk Array PLUS, Version 1.0, currently designed to run on the company's StarServer E, supports RAID (Redundant Array Inexpensive Disks) level 0, 1, 4, and 5 disk arrays. The software provides a menu-driven interface, and runs on your current set of disks. According to the company, the disk array can be configured without modifying existing applications. This feature, combined with the ability to perform on-line reconfigurations of RAID levels, allows system administrators to tailor the system quickly to meet the requirements of differing data types.

Disk Array PLUS also has a "hot spare" feature that provides a standby disk in the event of a disk failure within the array. It also has the ability to recover data blocks in the event that a read or write encounters bad blocks on disks. NCR plans to release Disk Array PLUS for the company's System 3000, 3400, and 3500 units in the near future.

•List price: *Disk Array PLUS, Version 1.0 (for the StarServer E)*, \$3,495. **NCR Corp., Peripheral Products Division, 3718 North Rock Rd., Wichita, KS 67226; 800-225-5627; 316-636-8000. Circle 411 on reader service card**

NEW

Primax Ships Its First Brand-Name Product: PrinterNET

OEM electronics and telecommunications equipment manufacturer **Primax Electronics** has released the **PrinterNET** Local Printer Network, its first product to carry the Primax name. **PrinterNET** allows up to 16 PCs and 6 printers to be connected for shared printing for less than \$100 per node. The system uses common telephone modular cabling and parallel port interfaces to connect PCs and printers, and features the company's Pop-Up Control software, a TSR program that allows you to select which printer you send your print jobs to. Print jobs are processed on a "first-in, first-out" basis. The **PrinterNET** Local Printer Network is available in a starter kit that includes two PC nodes, one printer node, and cabling and software.

•List price: *PrinterNET Local Printer Network Starter Kit*, \$249; *additional PC nodes*, \$99 each; *additional Printer nodes*, \$95 each. **Primax Electronics, 254 E. Hacienda Ave., Campbell, CA 95008; 800-338-3693; 408-379-6482; fax, 408-379-2009.**

Circle 412 on reader service card

BRIEFS

ACCOUNTING AND FINANCE

features a CompareActions report that performs an analysis on each model to help you identify courses of action to achieve profitability. The program uses Excel 4.0's new Scenario Manager feature, allowing multiple scenario aspects to be modeled and reviewed. 619-347-2365; fax, 619-347-6045.

Telereware's M.Y.O.B. for Windows, Version 3.0 (\$249), features importing of data from any database, accounting program, or spreadsheet; the ability to automatically build, buy or backorder items when inventory can't keep up with demand; multilevel password protection; enhanced receivable and payable analysis; expanded job costing; additional flexible invoices and purchase orders; customizable packing slips; and flexible credit terms that include COD, Prepaid, and Day and Month discounts and due dates. 800-237-6962, 201-586-2200.

ANTI-VIRUS AND SECURITY

McAfee Associates has unveiled NetShield, Version 1.0 (\$495 per server), a NetWare Loadable Module (NLM) for Novell NetWare 3.1. NetShield blocks viruses from being transmitted over a network by scanning files as they are accessed from the server. It also performs scheduled scanning of the server on either a daily, weekly, or monthly basis, providing several options for handling infected files. 408-988-3832; fax, 408-970-9727; BBS 408-988-4004.

Ontrack Computer Systems is shipping Dr. Solomon's Anti-Virus Toolkit, Version 5.55, equipped with a new scanning capability to detect polymorphic viruses. 800-872-2599, 612-937-5161; fax, 612-937-5750.

Parsons Technology's ViruCide Plus (\$69) is composed of ViruCide, and the new ViruCide Shield. 800-223-6925.

NEW

Optquest Rolls Out Fast 14-Inch Color Monitor

Optquest is shipping the 1500D, a new 14-inch color monitor. The \$645 monitor provides a .28-mm dot pitch, a speedy 72-Hz refresh rate, 1,024-by-768 noninterlaced resolution, and microprocessor-based digital controls. Pop open the front panel, and you have access to the unit's brightness, contrast, horizontal phase, horizontal position, vertical size, vertical position, and reset controls, all of which are incremental. There are 16 factory-preset resolution



The Optquest 1500D has a 72-Hz refresh rate.

modes, as well as 16 user-defined resolution modes.

•List price: *Optquest 1500D*, \$645. **Optquest Inc., 9830 Alburis Ave., Santa Fe Springs, CA 90670; 800-843-6784, 310-948-1185. Circle 414 on reader service card**

NEW

YOU/2: It's Not a Spy Plane

National A.I. Lab has unveiled YOU/2, a GUI-oriented, PC-based decision support software program that lets you build and distribute knowledge bases. The package is aimed at professionals, technical support personnel, and managers, and lets individuals pass on procedures and information for any situation in which "if-then" statements are applicable.

The YOU/2 Developer's Version (\$795) has a spreadsheet interface that lets you enter data in columns and rows, making it easy to cut, copy, and paste between worksheets, according to the company. The Runtime Version (\$495) is required to access the information.

•List price: *YOU/2 Developer's Version*, \$795; *YOU/2 Runtime Version*, \$495. **National A.I. Lab Inc., 2161 Newmarket Parkway, Marietta, GA 30067; 800-526-6245, 404-988-0909.**

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The best place to get your photos printed.

You don't need a photo lab to get output like this. A Phaser™ II SD color printer by Tektronix will do just fine. It's the only dye sublimation printer that gives you detailed, photorealistic images with crisp, clean text—that's TekColor Photofine technology. But you also get PostScript™ Level 2 and TekColor PS to match and adjust colors. Plus Pantone certification, networkability, a 24MHz RISC processor for speedy output, a \$9995 price tag and a print cost of about \$2 per page. All in one little machine. So much for that hut in the middle of the parking lot. Call the leader in color printers at 1-800-835-6100 Dept. 25E for a free output sample. Or call (503) 682-7450, ask for Document 1222 and we'll send information by fax.

Tektronix

Computer Graphics



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REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Carol Levin

Building AutoCAD Skills From the Ground Up

BY BRYAN M. WINTER

When it comes to breaking into the design field in today's job market, a solid foundation in computer-aided design (CAD) can only help. That's why more than a million architects, drafters, engineers, and designers have adopted AutoCAD as the industry standard. Daniel Raker's and Harbert Rice's *Inside AutoCAD* has helped a good many of these users learn this complex program from the ground up.

At over 1,300 pages, this edition updates current users on the new features in Release 12, including integrated rendering and easy dimensioning, and offers new users an affordable alternative to classroom training.

Inside AutoCAD is divided into five sections: setting up an electronic drawing and installing the optional \$19.95 disk of drawings, basic 2-D drafting, advanced 2-D, advanced features such as dimensioning and data extraction, and finally, 3-D modeling with photorealistic textures and reflections.

The team of writers who updated the original text introduces commands and theory in parallel. This approach works well for users who are just learning entities and properties and for more advanced users. Projects include step-by-step instructions and detailed screenshots, but readers are not led blindly through a maze of commands. Instead, the authors fo-

cus on the underlying logic of the software and explain the relationships between commands and variables and the many ways to edit drawings. Advanced users will learn from the review of external control files such as the .PGP file for controlling system functions, but if your focus is customization, look to New Rider's specialized AutoCAD books.

With its even balance of CAD theory and practice, *Inside AutoCAD* is a good buy for new users who need a basic tutorial and for ad-

vanced users who need to learn the new features in Release 12.

Also in the category of AutoCAD support references, George Omura's *Mastering AutoCAD Release 12* is one of the finest. As with *Inside AutoCAD*, the sheer bulk of the book can be intimidating; AutoCAD has evolved into a powerful program and there is a lot of ground to cover. *Mastering AutoCAD* is not casual reading, but time spent working with it can pay off.

Capably written and broad in scope, *Mastering AutoCAD* excels at giving hands-on tutorials that teach the mechanics of CAD drawing. The author begins with general commands to draw a simple door, progresses to an entire apartment, and to more advanced techniques for rendering 3-D

■ No CAD Experience Required

Who needs to spend \$3,000 for a CAD program? If occasional tinkering is your game, then Evolution Computing's EasyCAD2 may be all you need to design your own deck or addition. This 2-D drafting package represents a new class of low-cost CAD software, it works on XT's, and it's bundled with

Learn CAD Now (Microsoft Press, \$39.95, 800-677-7377). Author George Omura illustrates universal CAD concepts and creates a variety of sample projects, from kitchen floor plans to offices. It works with standard .DXF files, and you can upgrade to the full package when you're ready. *Learn CAD Now* is a great introduction to the world of CAD for people with unlimited ideas but limited funding.—BMW



models complete with light sources and camera locations. Chapters are cumulative, but they also stand alone, making it easy to review specific topics.

With Release 12, AutoCAD made the important transition from 2-D to 3-D modeling. Users hesitant to make the jump will find *Mastering AutoCAD* a reassuring gateway to presenting models in 3-D. Considering that CAD standardization has become an entire subprofession, one of the most important chapters is "Integrating AutoCAD into Your Projects and Organization." Chapters on advanced topics introduce AutoLISP programming and the Advanced Modeling Extension.

Hundreds of "Fast Track" notes summarize the tasks learned in each chapter and serve as shortcuts for users frantically trying to meet deadlines.

As in *Inside AutoCAD*, you'll also find tables of system variables and commands for quick referencing. It also comes with a disk of AutoLISP utilities. If you want—or need—to learn AutoCAD, a disciplined computer-side study with *Mastering AutoCAD* can introduce the program and enhance the work you create with the world's most popular CAD program.

• *Inside AutoCAD Release 12, Special Edition*, by Tom Boersma, Jim Boyce, Frank Conner, Rusty Gesner, Jeff Hester, Daniel Raker, Harbert Rice, \$34.95; New Riders Publishing, 11711 N. College Ave., Carmel, IN 46032; 800-428-5331, 317-573-2500. ISBN: 1-56205-055-9.

Circle 459 on reader service card
• *Mastering AutoCAD Release 12*, by George Omura, \$34.95, Sybex, 2021 Challenger Dr., Alameda, CA 94501; 800-227-2346, 510-523-8233. ISBN: 0-7821-1134-3.

Circle 460 on reader service card



IF IT DID ANY MORE,

The new COMPAQ PAGEMARQ 20 and COMPAQ PAGEMARQ 15. Two network laser printers that will immediately establish the industry benchmark. Printers for those who want nothing short of everything.

After rather extensive R&D, we realized the average network printer was doing more to raise your group's blood pressure than its productivity.

So we created two new network printers bristling with features that will help everyone work in harmony.

For starters, COMPAQ-built, RISC-based controllers, in combination with powerful print engines, let our printers run at 15 and 20 PPM. And at 20 PPM, that's 100% faster on average than HP LaserJet III Si



in PostScript applications.

And the ability to print in sizes up to 11" by 17" will really make your day. Especially if it's filled with everything from envelopes to double-page layouts to CAD plots to spreadsheets.

The built-in motorized paper trays can hold up to 1,500 sheets, more than any other desktop printer. So you can think about things other than loading paper.

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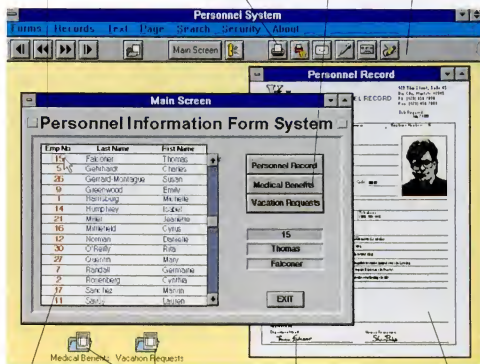
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Edited by Trudy Neuhaus

Build Object-Oriented Databases in C++

BY RICHARD HALE SHAW

Raima Object Manager, Version 1.1, is a C++ class library that lets you build object-oriented database applications and add persistence to existing C++ classes. (Persistent classes are object classes that can be stored on and restored from disk).

With object-oriented database management, instead of creating and managing a file by calling functions in an API, you create an object for each database or table. These database objects have specific member functions and operators for navigating and updating the database. Such objects also encapsulate and hide database operations, while offering a simpler, more sensible syntax.

Under the hood, Object Manager uses Raima's Data Manager to navigate and update a database sequentially or by using the relational or network database models. Sequential access works best on nonindexed flat-file databases. The relational model lets you create one-to-one, one-to-many, and many-to-one relationships between tables via a key made up of fields in both tables. The network model lets you treat a

table as a double linked-list, where you can navigate between the records of a table via pointers that are hidden in each record; you create one-to-many relationships by creating a set of records in one table whose members are "owned" by records in another table.

Object Manager offers all three approaches, but hides the access method details from your applications. It offers an identical interface regardless of which access method you select, so your code remains largely the same. You can even use different access methods on the same table and switch between them in the same application. The secret? Object Manager overloads the class constructor for its database object class, and uses virtual functions to implement the access methods. There is one constructor for each of the three access methods available. Consequently, when you create a database object, the constructor you select determines which access method Data Manager uses.

Object Manager also takes advantage of C++'s operator overloading to provide customized operators for navigating a table. This allows concise, idiomatic C++ expressions in your

programs, and lets you conceptually treat the database as a simple array of objects.

For instance, Object Manager overloads the array operator ([]) to let you read the records in a table. If salesOrder is a database object, then salesOrder[FIRST] reads the first record, and salesOrder[LAST] reads the last one. (FIRST and LAST are among several macros Object Manager defines.)

There's more. Object Manager lets you use this technique to perform keyed lookups: salesOrder["Johnson"] will return the first record where "Johnson" matches the key. And you can use the increment and decrement operators to iterate through the table. For example,

```
for (salesOrder[FIRST];
     !salesOrder.EOF();
     salesOrder++)
    salesOrder.Display();
```

will start with the first record in salesOrder and move, record by record, to the last record. (Here, Display is a member function that you define to display the contents of a record and EOF returns TRUE when you reach the end of the file.) You use salesOrder[FIRST] to navigate to the first record in the table, salesOrder++ to move to the next one, and end when EOF returns TRUE. It's simple. The code stays the same regardless of access method.

Object Manager also overloads the << and >> operators to simplify database navigation. You can use >> to find and read the first record in a set when using the network data model, or to find the first keyed record under the relational model. Thus,

if SalesDetail is a member of a set owned by SalesOrder, then the code in Figure 1 would loop through all the salesOrder records, displaying each one and its associated salesDetail records. Try to do that in C!

To create persistent classes first, #include the appropriate Object Manager header files in your C++ programs. Second, use multiple inheritance to derive new classes from your old ones and the Object Manager StoreObj class. Now, with a few minor changes to your source code, you can save and restore objects of the new class.

There are certain Data Manager libraries and header files that Object Manager needs. If you already own Raima's Data Manager, all you have to buy is Object Manager. If you don't, you can purchase the integrated version of Object Manager, which includes the necessary Data Manager files. Or, simply purchase Raima's Data Manager, which ships with Object Manager.

At a time when no one else—including Borland or Microsoft—has released an object-oriented database manager (much less one for developers), C++ programmers have an excellent tool available: Raima Object Manager. □

• Raima Object Manager, Version 1.1

List price: DOS version, \$395; Microsoft Windows version, \$495; integrated DOS version, \$595; integrated Windows version, \$795. Requires: DOS 5.0 and Borland C++ 3.1, Microsoft C++ 7.0, or Zortech C++ 3.0. Raima Corp., 3245 146th Pl. SE, Bellevue, WA 98007; 800-327-2462.

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Figure 1

```
SalesOrder salesOrder;
SalesDetail salesDetail(salesOrder);

for (salesOrder[FIRST]; !salesOrder.EOF(); salesOrder++)
{
    salesOrder.Display();
    for (salesOrder >> salesDetail; salesDetail.Okay();
         salesDetail++)
        salesDetail.Display();
}
```





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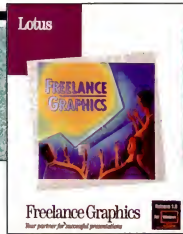
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Michael J. Miller

New Spreadsheet Thinking

Let's face it. If you want to create a basic spreadsheet, do some rough calculations, balance your budget, or do a few quick "what if" analyses, any one of the spreadsheets in our cover story, "The New Spreadsheets: Diversity Blossoms amid the

Rows and Columns," can handle the job. So the major spreadsheet vendors have been concentrating, instead, on adding features and improving user interfaces in an effort to make the common spreadsheet-creation tasks easier.

This is particularly true of Borland's new Quattro Pro for Windows, but you'll see plenty of innovative ideas in Microsoft Excel and Lotus 1-2-3 as well. Indeed, all the graphical spreadsheets have obvious ease-of-use advantages over their DOS counterparts, including better fonts, better consolidation handling, and better access through Windows' ubiquitous icon buttons.

Developers have come up with a variety of ways to refer to a collection of these buttons: Microsoft dubs it a Toolbar, Lotus says SmartIcons, and Borland prefers SpeedBar. But they all serve the same purpose: to perform the most common spreadsheet tasks in a single click. For example, Excel pioneered the AutoSum feature, which tells the program to sum up the most likely series of cells automatically. This concept was so simple—and so obvious—that all the Windows spreadsheets have now adopted and extended this metaphor. Excel has AutoSum; 1-2-3 has SmartSum; and Quattro Pro has SpeedSum. Now, all the programs have Auto, Smart, or Speed sort, fill, and formatting features. Also, icons that let you cut, copy, and paste data are de rigueur, and every Windows spreadsheet has graph buttons so you can select a range and create a simple graph with just one click.

These features are beginning to migrate back to DOS spreadsheets. But in every case I know of, the graphical spreadsheets simply do the tasks faster. You could argue that DOS spreadsheets scroll faster, require less hardware, and are more familiar than

Windows spreadsheets. But graphical spreadsheets make it easier to perform all kinds of everyday functions.

THEME AND VARIATIONS

While all the major spreadsheet developers are adding icons and graphical features in their attempts to make their programs easier to use, today's spreadsheets are in fact more different from each other than they have been in some time.

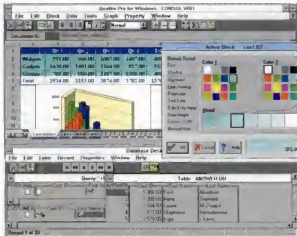
Take the problem of working with multiple, related worksheets of information. All the major spreadsheets have some way of handling consolidation, but they take widely divergent approaches.

The most familiar approach, which I remember using in Boeing Calc, is the 3-D spreadsheet in 1-2-3, Release 3 (and subsequently in 1-2-3 for OS/2 and 1-2-3 for Windows), and in CA-SuperCalc. Here's the idea: You have multiple sheets, each with alphabetic labels, so you end up with spreadsheet cells with labels such as A:A1. This approach is perhaps the most powerful; it lets you create extremely large, complicated models, but it isn't all that intuitive, and it tends to confuse users.

Instead of going the full 3-D route, Excel has tried several variations on the 2-D theme to let you link spreadsheets easily. You can use a macro feature to consolidate similar spreadsheets. You can even combine multiple spreadsheets in a workbook.

All of these things are useful, but they aren't equally accessible. Selecting ranges and getting consistent formatting across multiple spreadsheets just isn't as easy in Excel as it is in 1-2-3.

Borland seems to have come up with a simple yet powerful solution to multi-



All spreadsheets do a good job. Now, developers are taking great strides in improving ease of use.

Michael J. Miller

ple spreadsheets with its Notebooks. As in 1-2-3, the basic file format in Quattro Pro for Windows has multiple sheets. But in QPW, each sheet stands out as if it were a page in a notebook. Because the notebook metaphor is so familiar, and because you can give each page a descriptive name ("Eastern" instead of "A") and even refer to spreadsheet cells by the name of the sheet ("Eastern:A1"), QPW makes 3-D spreadsheets much more intuitive than other packages do.

While the notebook metaphor is the most obvious new innovation in Quattro Pro for Windows, it's not the only one. In fact, the biggest technical accomplishment is the Property Inspector, which lets you modify just about any part of your spreadsheet by clicking on the right mouse button. You can change the color of the text in the cell, the background, the shading, the numeric format—almost anything.

Excel 4.0 moved in this direction, with its Shortcut Menu (which has some of the same features, plus the useful ability to cut,

copy, and paste), but it's not nearly as complete as QPW.

SPREADSHEET SPECIALTIES

Quattro Pro also ships with Database Desktop, a database query tool that lets you easily access and query dBASE and Paradox files. With its check-box form of query by example, borrowed from Borland's upcoming Paradox for Windows, it makes querying an external database far easier than the query tools in the other products. You can also link your results back to your spreadsheet. However, it does have its limits: By itself, Database Desktop cannot query a SQL database. Expect to see other developers devote a great deal of effort to improving their database links for their next releases.

While QPW has added a few new wrinkles to spreadsheet user interfaces, it's not the only innovative player around. Microsoft Excel has one feature none of the other graphical products have attempted—spreadsheet outlining. This lets you control the level of detail you see in your spreadsheet by expanding or collapsing rows and columns. You could collapse your spreadsheet so you see only totals or subtotals, or expand it to see all the details. It's a great

idea, and I like it a lot, but it may be too difficult for most people to handle. Alternative ways of looking at a spreadsheet—like those used by Computer Associates International's CA-Compete! and Lotus Improv—may take this concept and make it much more popular.

Excel also has the broadest range of functions in any of the shipping spreadsheets, and it's the only one with a built-in spell-checker.

Lotus 1-2-3's Datalens feature is very powerful, although it doesn't have the graphical user interface of the Q+E add-on that comes with Excel or QPW's Database Desktop. And Lotus has also publicly demonstrated a feature called Chronicle, designed to help multiple users deal with multiple changes to a spreadsheet model. Excel has the Scenario Manager, but it doesn't have the multiuser features that Lotus has demonstrated.

Over the past few years, we've seen a lot of effort toward simplifying the everyday aspects of dealing with two-dimensional spreadsheets: entering data, adding, sorting, and formatting. Who knows? One day, features that deal with external databases, multiple-sheet models, and multiuser access will become nearly as simple. □

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Bill Machrone

Electronic Mail: Threat or Menace?

Progress is always at the expense of something. The typewriter ruined handwriting. The telephone made correspondence a forgotten art. Electronic mail has changed business communications forever, but maybe the change isn't all bad.

When I started in the business world, you wrote a memo longhand or dictated it to a secretary. She would then scroll a piece of letterhead into the typewriter with two or three sheets of carbon paper and typing tissue. If she made a mistake, there was a small arsenal of Wite-Out, erasers, brushes, Ko-Rec-Type, and platen shields to correct it. For low-level correspondence, you always had snap-set carbonless forms with room to write a quick request and room for your addressee's reply. The minimum unit of time required for business correspondence back then was a day, and that was if you really pushed it.

Copies were another issue. You could get an original and five carbons out of a Selectric typewriter with the right materials, but reading that last copy was an exercise in pattern recognition. If a memo had to go to more people than that, it was mimeographed. The most accurate secretary in the department typed up a Ditto master, then emerged from the mimeo room some time later, dazed by the fumes. In this building of several thousand industrious souls, there were two Xerox machines, each guarded more jealously than a sultan's harem. I never understood the point of having business machines that you couldn't use, but they shared an unhappy combination of the traits of early technology: They were expensive and broken.

The state of technology dictated the state of business: Written correspondence was to be avoided unless it was absolutely necessary. Memos of importance were posted in common areas where all could see them. Snap-set forms that required a minimum of filling in the blanks were the norm. Decisions were made at the same languorous speed as the oscillating fan that cooled the many parts of

our building that weren't air-conditioned.

Today, America runs on e-mail. Immediacy is built-in. The wires crackle with our electronic tappings, and I find myself rankling at even the 1- and 2-hour delays as servers update one another across the country. When a crisis comes down, I'm always amazed at how fast we're able to make a decision, even through a handful of time zones, dozens of opinions, and hundreds of on-lookers.

E-mail's immediacy has a downside, especially when people respond in haste or in anger. Who hasn't received an e-mail "flame" that was at best ill-advised, at worst career-damaging? Worse, who hasn't sent one? If you had tried to write an angry memo back in the old days, your secretary would have come in with a re-proving frown or a suppressed smile and said, "Do you really want to send this?" E-mail lets us be our own worst enemy.

Also, written communications obviously are bereft of the body language and tone of voice that convey so much in face-to-face meetings and even in telephone conversations. I'm surrounded by articulate people who write for a living, and sometimes our communications

tend to misfire. You have to work much harder to build in humor, sarcasm, or disagreement without having your words come across as stupidity, rudeness, or truculence.

Nowhere are e-mail flames more apparent than on services such as CompuServe and our own PC MagNet. Disagreement and frustration on these public forums often reduce communications to personal attacks. One supposed way of defusing misunderstanding is to include clues to your emotional state, which have come to be called emoticons. A bracketed



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PrintDirector Gold Turbo printed nearly five times faster than Novell Lite, almost 2 1/2 times faster than ASP Port Authority, about twice as fast as ESI Share Spool and Buffalo SLMkII, and 40% faster than Lantastic. *Based on printing an output file created with Harvard Graphics. Total time for three PCs to print concurrently to two printers.

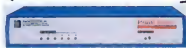
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Bill Machrone

<g>, for instance, is shorthand for a grin, and <g,d&r> means grinning, ducking, and running.

My problem with all this is that I commonly see people write the most appallingly insulting things to one another. They then shrug it off with a <smile>. I consider this I-didn't-really-mean-it technique to be a cop-out, a thinly disguised hostile and unbusinesslike act.

Electronic mail is the VCR of business communications. It allows us to time-shift and prioritize our communications as we skip across time zones, attend meetings, or get some sleep. I've never failed to be amazed at how many messages accumulate from the time I turn the machine off at night to the time I get up in the morning. Somewhere, somehow, people are working. And they want to tell me about it. I prefer that they tell me in plain English.

ON ANOTHER NOTE...

I've been carrying the Gateway Nomad 420SXL notebook these past several months, and it's one terrific machine. Although it does violate my "nothing over 5 pounds" rule by nearly a full pound, the extra weight gives me just what I've always wanted: incredible battery life.

My laptop machine goes with me everywhere, every day. I use it on the train to and from work, and sporadically throughout the day. I leave the charger home. I use it on my frequent coast-to-coast flights. I seldom turn it off, even for meal services. I just put it in standby mode, then resume when my meal tray is cleared. At the end of the flight, there's still plenty of juice to transmit all the e-mail messages I created.

The 420SXL, designed and built by Texas Instruments, replaces my trusty TI 2000, which was lighter and thinner but required that I carry a spare battery for the longer jaunts. My hat is off to the engineers who tamed the 486SX's voracious appetite for power and thereby kept its awesome heat-generating propensities under control. I've used 386SX machines that ran a lot hotter—the 420SXL barely gets warm. I've replaced the supplied Thumbelina trackball with a Microsoft BallPoint Mouse, which is larger but gives me better control. For serious pointing and clicking, however, I still prefer a mouse.

My next laptop will likely be one of the under-4-pound wonders—a first since I started carrying a Radio Shack Model 100 in 1983. □

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COMPACT YET COMPLETE. 1.3 lbs!

At only 9 1/8" x 4 1/8" and only 1.3 lbs., what's great about the ZEOS Pocket PC is that it has a keyboard you can really use. If you're accustomed to typing with both hands, switching to a palmtop PC can be awkward because the keyboard only lets you type with one hand or even one finger. Yet the ZEOS Pocket PC's keyboard lets you use both hands easily, so you won't sacrifice comfort and speed for portability.

And even though it's small, the ZEOS Pocket PC carries a *full suite of industry standard software* already loaded and ready to go! You get *Microsoft DOS 5.0* system files with built-in file transfer and *Microsoft Works 2.0* with word processing, spreadsheet, database and communications programs. Plus, you get a personal organizer which includes a calendar/planner, "to do" list, business card file, information retrieval (for country codes, converting measurements and currency) and more. It's everything you need to manage your life!

IT JUST KEEPS GOING...

Ten hours of continuous use? Absolutely! All it takes is the two AA alkaline batteries included with your system. And your ZEOS Pocket PC has great power management, too—it automatically switches to the suspend mode when you take a break. Plus, when you turn off your system, then turn it on again, it goes right back to where you left off. What a time-saver!

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PC Magazine, in their recent Service and Reliability issue said, "Only ZEOS portable PCs achieved significantly higher-than-average ratings in all four categories." The four categories were *reliability, future purchase plans, repair service satisfaction and technical support*. And remember, ZEOS technical support is 24 hours a day, 365 days a year, and always toll-free. And we back every ZEOS purchase with our 30-Day Absolute Satisfaction Money-Back Guarantee, One Year Limited Warranty and more.

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CIRCLE 036 ON READER SERVICE CARD





John C. Dvorak

The Raging Debate over OS/2

Among the staff at *PC Magazine* and at other publications, there is a mean-spirited debate going on over the merits of OS/2. There are basically three groups arguing. The first consists of staffers who can't get OS/2 to run or even load. These

people are usually running oddball systems or borderline minimum-configuration computers. I include in this group the ones who do get it to run in, say, 5MB, then complain about the performance.

The second group includes the OS/2 old-timers who have been using the operating system since Version 1.0. They have a disdain for the rest of the users, period.

Finally, there are the OS/2 newcomers, who use it without comment for day-to-day work. The last group includes people like myself, who have to explain to everyone why we disliked OS/2 for so long and now use it day after day. The arrogant old-timers keep pointing out that many of the most beloved features "were there since Version 1.3!"

Well, maybe OS/2, Version 1.3, was great. I, like so many others, never really bothered to try it. Things were different in the early days of OS/2 hype than they are today. It's those differences that are contributing toward a newfound life for OS/2.

Let's go over the differences and try to understand the social mechanisms that have allowed OS/2 to quickly sell over a million copies in today's world.

There are five important changes that took place between the various releases of OS/2, Version 1 and Version 2.0. Each change has significantly affected the market.

1. **The price of memory.** When OS/2 was announced in 1987, we were beginning to see one of those weird memory shortages. By the time OS/2 was ready to ship, memory was selling for \$400 a megabyte. What I consider a minimum memory requirement for OS/2 (to make it perform with snap) is 16MB of RAM. That used to cost \$5,600! A little pricey. In fact, it was ridiculous. Today, memory can be had for as

little as \$25 per megabyte, and 16MB of RAM will cost as little as \$400. That's a big difference.

2. **The processor of choice and the price of the machines using that processor.** In 1987 there was no 486 machine, and the fast 386 ran at 25 megahertz—and it was expensive, selling for up to \$10,000. This situation has changed dramatically.

3. **Compatibility with Windows 3.0 and DOS.** OS/2's inclusion of Windows compatibility means users can run the hot Windows applications. This is a new feature. It also saves the user money. The user doesn't need to buy DOS and Windows.

4. **Proliferation of utilities in the DOS world.** Another attractive aspect of OS/2 is that it eliminates the need for extensive utilities such as memory managers (and books on memory managers) and other pricey DOS extenders and enhancers.

5. **The price of OS/2.** When OS/2 was first discussed it was going to be priced high, at around \$500. Who wants to pay \$500 for an operating system? We want it cheap or free. IBM lowered the price and made it easy to obtain for as little as \$49!

The other difference between then and now is that

Microsoft is out of the picture as far as the code is concerned. The product seems better off, making me doubt Microsoft's sincerity in the first place.

There's a trend to note in the above list. The one common aspect of the changes in the market conditions is that everything is oriented toward more power for less money. Cheaper machines, cheaper memory, cheaper operating system. Suddenly, a million copies are sold. As usual, the users send the same message: Desktop computing is price-driven. Will the big companies ever learn?



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Inside Track

Microsoft Corp. has shipped **MS-DOS 6.0** to beta testers. DOS 6.0 is not going to see any major code changes, say observers, but will include a **slew of new utilities**, such as built-in antivirus scanning, disk defragmenting, elaborate backup systems, and data compression! The makers of utility software are **grousing** that this will put them out of business. DOS 6.0 is scheduled to ship in early 1993. Bankruptcy filings will appear elsewhere shortly thereafter.

By early 1993, IBM is expected to produce **OS/2, Version 2.1**, which will incorporate Windows 3.1 and **fix minor bugs** reported by users over the past six months. In the meantime, **IBM is looking carefully at Mach**—the Unix-like operating system—for inclusion in a future release of the product. This way OS/2 will be better able to compete with Windows NT, which is also supposed to be very Unix-like.

Bad Timing Award Dept.: Compression is the hot item in 1992 and will continue to be important in the next few years as applications tax the limits of storage devices. Stacker and SuperStor are two of the hot compression packages that allow you to double your hard disk capacity. Anyone involved in graphics knows that compression schemes such as JPEG and MPEG are in the news. **The latest buzzterm is "fractal compression,"** a new technique to crunch pictures by as much as 100 to 1! You know everyone's become compression-mad when **Intel** announces a printer coprocessor that uses compression to reduce to nil the need for printer RAM. The chip will be used first in pricey high-end printers. Now let's look at this objectively. This chip is designed to replace cheap \$25-per-megabyte memory. **Where was Intel with these ideas when a megabyte cost \$400 or more??!**

A Need Waiting for a Solution Dept.: Finally, Hewlett-Packard has developed a cartridge that allows laser printers to produce bank checks with the magnetic ink required by banks. Along with the toner cartridge, you get a special font cartridge to produce the crazy little OCR letters at the bottom of a check. According to the company, the check printer system will allow a cheap laser printer to do the same job as special machines costing \$10,000. What intrigues me is the **potential for screwing up the banking system** by putting wrong magnetic numbers on checks.

Speed Dept.: Look for CD-ROM performance

*Microsoft is bringing
in a bunch of experts
who were weaned on
minis and mainframes.
All smart guys who
haven't a clue about
\$49.95 software for
the masses. Is this the
beginning of the end?*

enhancements over the next year. Already, NEC has released a CD-ROM drive with **twice the rotational speed** of normal drives, giving it half the access time and twice the data rate. Scientists are working on a new generation of so-called blue-light lasers that at least triple the data capacity. Thought you should know.

While on the Subject of Spinning Dept.: You've all probably heard that IBM has spun off its personal systems division. **The reason is simple:** IBM's bureaucracy hampers innovation and hurts the competitive edge needed in the desktop computing arena. The big question in my mind is why the new entity is being called The IBM Personal Computer Co. I

thought sure they'd call it IBM/2!

IBM and other companies have trouble competing with Microsoft largely because Microsoft's chairman, Bill Gates, is a **microcomputer baby**. Born and raised with the small machines, he actually likes the little devices, while many **old codgers** in the business were weaned on mainframes and don't understand the small-computer scene. Observers wonder how long Gates can keep his edge. Already he's bringing in experts from outside the small-computer business. Richard Rashid, a Carnegie-Mellon University professor of computer science, was named research director. On top of that, Gates added a bunch of minicomputer types, including Gordon Bell, formerly of Digital Equipment Corp., and John Hennessy, professor of computer science and electrical engineering at Stanford University (and a cofounder of MIPS Computer Systems). While they're **all smart guys**, none have a clue about \$49.95 software for the masses. It's the beginning of the end as far as I can tell.

Finally, I got this memo. It was tied to a brick and thrown on the porch. "John, here's your conspiracy theory for the day: You know about AT&T's 'CAP 32' modem technology and how they plan to apply it to FDDI/CDDI bandwidths on level-5 wire? Just like 10BaseT: Create a technology that won't work on existing wire; give the technology away so you can make all your money selling the level-3 wire to all of the rafter rats who rewire buildings. Hell, they even got the magazines to call it a standard.

"But this time, the CAP 32 chip will cost \$200 a pop, and it won't even work on level-3 wire! They're going to force users to level-5 wire so they can make more money on all the wire it will take to rewire every building, again, just as America got done putting in level-3 wire."

Stop your whining. This is what makes America great! □

Right-sizing.



3

The perfect system isn't

There are trends and fashions even in the logical world of IS, and right now "down-sizing" is a hot one. You read about it all the time, usually accompanied by an obituary for mainframes.

Needless to say, this gets our attention at IBM, and not just because we make big systems.

We make systems of every size, and based on experience with real customers, we'd say that "right-sizing" is a more useful term than "down-sizing." Especially since a number of companies described as down-sizers not only keep their mainframes, they use them as actively as ever.



what's fashionable, it's what fits.

To us, the real challenge is choosing the right combination of systems, not just for running client/server applications but for managing their complexity.

Open, distributed environments can make heavy demands for storage, security and network management—jobs that mainframes are made for. Suddenly companies who never dreamed of owning IBM ES/9000™s will praise their arrival but not because they're big, because they're right.

Meanwhile, other companies who chose mainframes ten years ago may be considering other options like AS/400™s or RISC-based networks,

and we're helping them do it.

For example, while Lincoln National Life has a network of IBM RISC System/6000™s for running client/server applications, the University of Virginia Medical Center chose an ES/9000 for developing and processing medical record applications. For Royal Caribbean Cruise Lines, an IBM AS/400 is just the ticket for booking passengers. Who's right? They all are.

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Jim Seymour

Software Prices: Bottomed Out?

Since the collapse of PC hardware prices drew headlines over the summer, users and corporate buyers of PCs have been asking whether software prices would take a similar plunge. It ain't gonna happen. And in a minute, I'll tell you three

reasons why not.

But first, I don't want to treat lightly this idea that software prices will plummet—and should. It's an appealing idea from the buyer's perspective, and there's a certain logic to it as well. In the IBM PC era, mainstream application packages have traditionally sold for 10 to 15 percent of the actual selling price of the machines on which they're run. Thus, when we were paying \$3,500 to \$4,000 for realistically configured PC-XTs, ATs, and 386s, paying \$350 to \$500 for primary business applications such as Lotus 1-2-3 or dBASE wasn't out of line.

Now that the PCs most people use in business sell for \$1,500 to \$2,500, doesn't it make sense that software prices should fall, too?

Moreover, if the market has wrung the fat out of PC hardware prices, won't it now do the same thing with software prices? Isn't it outrageous for mainstream apps to be list-priced at \$495 to \$595, even though their street prices hover around \$300?

Maybe, but don't expect those list prices to fall.

It won't happen because the explosion of competitive upgrades led to a permanent restructuring of PC software pricing. It won't happen because the major software publishers neither want it to happen nor would benefit from it. And finally, it's not going to happen because it *already has happened*.

My first and third reasons are really two sides of the same coin. The creation of competitive upgrades—an idea generally credited to Borland—has turned the world of PC pricing upside down. With most major PC applications available for about \$99 to anyone who owns a competing product, maybe \$129 to someone who owns any earlier ver-

sion of the same program, or even less through direct-mail offers and large retailers' promotions, street prices for single copies of programs have come to be as meaningless as those \$500 list prices.

Only a small minority of the copies of most best-selling applications are sold these days as single-copy, standalone units. Instead, the apps go out as upgrades to a software company's installed base; as competitive upgrades to users of other, similar products; preloaded on a computer's hard disk as part of a bundling deal with a hardware maker; or as part of a software publisher's own bundle, as with Lotus's SmartSuite For Windows and Microsoft's Office.

Those all-in-one-box bundles help software publishers gain market share, but at a price: The publishers typically sell these bundles not for the 50 percent of list price that we're accustomed to paying for single applications, but for only about a fifth or a sixth of the programs' combined list prices.

Thus, we're already paying much, much less than we were, on the average, for the same top-of-the-line programs a year or two ago.

In other words, the collapse in software prices actually preceded the collapse in hardware prices. *We just didn't recognize it for what it was.*

Prices are unlikely to be cut in half again—as my corporate-buyer clients hope—because there's not much left for most large software companies to cut, and because further cuts probably wouldn't boost those companies' sales or market share. Even the most financially solid software publishers are watching the software market with one eye and the stock market with the other. Sure, Microsoft looks like it's booming: It has several of the best Windows appli-



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Jim Seymour

cation packages, and it's harvesting the riches of being first with the good stuff. But even Microsoft is getting roughed up on Wall Street these days, with its stock losing momentum.

Lotus got massacred in midsummer; the company's shares lost more than a quarter of their value in just two trading days, after Lotus told analysts its second-quarter performance wouldn't meet their expectations. Software Publishing Corp. got whacked a week later. Borland has been getting cuffed around all year; ironically, this should have been a soaring financial year for the company, if only its Windows versions of Quattro Pro and Paradox had shipped on time.

Note that these companies are getting clobbered in the midst of roaring sales. The Software Publishers Association reports that during the first quarter of 1992 application software sales for North America were up almost 20 percent over the year-earlier quarter. Sales of Windows apps were up 98 percent, and Mac apps were up 51 percent.

So it's not as if these companies aren't moving the goods.

What has happened is that the downward pricing pressure already well established by the first of this year simply squeezed the profits out of those booming sales for many large software companies.

Thus it's unlikely that, even as a gamble on increasing their market share, the major PC software firms are going to cut any deeper. They're down to bone and marrow already.

If you're a big buyer of PC software, you may be able to wring a bit more blood out of the turnip. For "important customers"—the kinds of high-profile companies software shops want using their products—it's sometimes possible to shave another 25 to 30 percent off the posted unit prices on competitive upgrades.

We saw that in late summer, when Borland persuaded Price Waterhouse to switch to Quattro Pro, for a price generally understood to be in the mid-\$60s per unit. But that price was for many thousands of copies to a customer Borland badly needed to maintain its momentum. Mere mortals and smaller, less visible companies shouldn't count on such deals.

PC software is an incredible bargain today. Don't stay on the sidelines, hoping for further price cuts but ignoring the opportunity cost of struggling with the old stuff just a little longer.

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William F. Zachmann

RISC: The Time Has Passed

RISC was widely and aggressively touted in the late 1980s. Its supporters said that new reduced instruction-set computing microprocessors would soon blow Intel's x86 processors out of the water and off the desktop. So far, though, RISC

hasn't even made a dent in the personal computer market. Is there any reason to expect a change anytime soon? The answer is yes and no, but mostly no. Let's see why.

First, the so-called RISC microprocessors do not in fact have spectacular performance benefits compared with so-called CISC (complex instruction-set computing) microprocessors. Those theoretical advantages were greatly exaggerated in the first place. A smaller and faster instruction set, for example, also requires that more instructions be executed. In addition, strategies such as multiple register sets and pipelining are not directly related to reduced instruction sets at all. Traditional x86 processor designs could employ the same strategies.

In fact, the so-called RISC microprocessors aren't even close to being purely RISC designs. They have quite large and complex instruction sets compared with "pure" RISC concepts. They are more accurately described as *RISC-influenced* rather than as *RISC* microprocessors.

The practical result of all of these factors is that x86 processors from Intel and a growing number of competitors, such as Advanced Micro Devices and Cyrix, have held their own very well against the newer RISC-influenced designs. The x86 processors not only offer very competitive price/performance ratios, compared with the so-called RISC alternatives, but are increasingly competitive in high-end performance as well.

The second reason RISC processors haven't had much impact on the personal computer market is summed up in two words: backward compatibility. Users simply aren't about to give up what they've already got.

The success of Microsoft Windows 3.0 and of OS/2 2.0 illustrates this point.

Neither Windows 1.x or 2.x nor OS/2 1.x was a very successful product. The earlier versions of both packages suffered from the same flaw: inability to run the applications users already had. Both got on the road to success once a version that could run old applications well was introduced.

RISC architectures have the same fundamental problem that Windows had prior to 3.0 and OS/2 had prior to 2.0: The systems don't run users' existing software very well. But Windows and OS/2's backward compatibility could be improved. RISC systems will never be able to run x86-architecture software as well as the systems for which those applications were originally designed.

The x86 architecture will always provide better backward compatibility than software emulation of that architecture on the newer RISC designs.

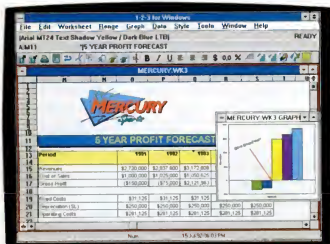
Does that mean that newer RISC-influenced microprocessors will never successfully challenge the x86 for the PC desktop? No. As object-oriented tools and intentional cross-platform development become more common (and they surely will), it becomes easier to provide versions of software for new architecture. Such cross-pollination reduces the compatibility barrier significantly and may pave the way to greater acceptance of RISC-based systems in the future.

All that will take time, however. I highly doubt we'll see a serious challenge to the x86 architecture's dominance of the personal computer market sooner than 1995 or so. Systems that use our familiar x86 architecture are likely to continue to dominate at least until then, if not longer. □

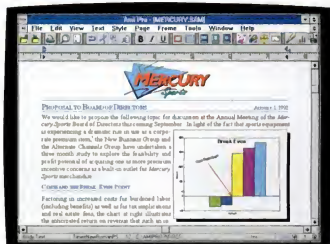


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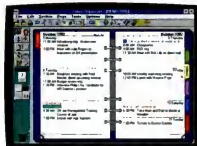
Of course, both SmartSuite™ and Microsoft® Office include full-featured products. But SmartSuite has been recently updated to include 1-2-3™ for Windows Release 1.1 with SmartPak™ and the newly released Ami Pro® 3.0, as well as Freelance Graphics® and cc:Mail™.

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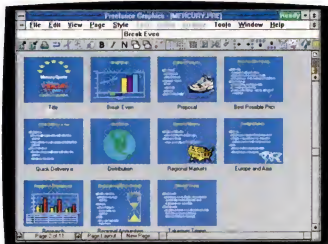
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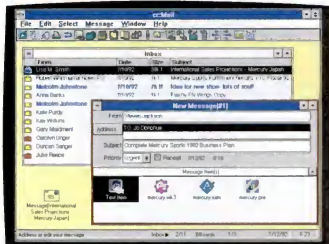
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Lotus

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THE NEW SPREADSHEETS

Diversity Blossoms Amid the Rows And Columns

Today's spreadsheet market encourages developers to pursue new paths. You can pick from analytical power, portability, and more.

This is a time of sea changes in the spreadsheet business. Users are switching platforms, or at least thinking about it. Major corporate accounts have recently divorced their erstwhile spreadsheet vendors and announced new alliances. A legal battle (apparently resolved at last) has forced companies to rethink their tactics for providing compatibility. And, most important, some exciting new products have proved that all the great ideas haven't yet been used up. So much unrest may be tough on stock analysts and seers, but it's good news for users.

On the DOS platform, Lotus Development Corp. appears to have won its long-running legal fight with Borland International. Lotus's contention that Borland's inclusion of an optional Lotus 1-2-3 menu tree in Quattro Pro constituted copyright infringement was sustained by summary judgment, and Borland agreed to lop off the offending tree. Meanwhile, in the weeks immediately prior to Judge Keeton's ruling, two major accounts

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by Craig Stinson

publicly forsook Lotus (one for Quattro Pro and one for Microsoft Excel), thereby adding to the ongoing erosion of 1-2-3's market share.

Whether the copyright suit will have chilling effects on innovation in spreadsheet design, as some have claimed it will, remains to be seen. But the growing balance in market share could eventually render the question moot.

On the Windows side of things, Excel remains the front-runner. Since our last review ("Spreadsheets Begin to Put the User First," December 31, 1991) Microsoft Corp. bestowed another major upgrade upon its premiere Windows application, adding (among other things) a library of advanced functions, a wealth of new statistical commands, a crosstab generator that is easy enough for anyone to use, a beefed up optimizer with integer-programming capability, drag-and-drop cell manipulation, and direct support for

1-2-3 macros. Recognizing the inevitable growth of competition in the Windows arena, Microsoft turned Excel 4.0 out in a little more than a year—the shortest development cycle so far for an update to the Excel program.

NEW BLOOD

Competition has arrived in force, in the form of Quattro Pro for Windows. Borland International's first Windows spreadsheet product, while adopting some of the ease-of-use innovations of Microsoft Excel 4.0, offers users some clear alternatives to Excel's ways of doing things.

Excel's basic modeling unit, the .XLS file, is a two-dimensional worksheet grid. The program provides all sorts of services

that allows users to link worksheets, including an intelligent Consolidate command (which can roll up subsidiary sheets even if they don't have the same row-and-column structure) and a new workbook

option. A workbook in Excel can be either a collection of separately stored documents identified and retrieved by a single name (exactly analogous to a "workspace" in earlier versions of Excel) or a collection of documents tucked into the

same bed and stored as a unit on-disk.

QPW's basic document, in contrast, is a multipage worksheet. Borland calls it a notebook and displays notebook-style page tabs along the bottom of the document window. Users can flip from page to page by clicking on the tabs, just as they might thumb through a personal phone directory.

This simple idea by itself makes QPW's three-dimensional files significantly more usable than those of CA-SuperCalc, Version 5.5, 1-2-3, Release 3.1, or 1-2-3 for Windows. But the notebook concept has more to offer besides easy navigation.

SMART AND SPIRAL-BOUND

For example, notebook pages can be named, and their names can be used in formulas just as range names can. Page tabs can be dragged and dropped for easy worksheet rearrangement. And when you copy a range from one page to another, QPW gives you a choice of maintaining absolute references (so they still reference the source page when pasted into the target page) or updating absolute references to point to the corresponding cell on the target page. The latter option, which QPW calls Model Copy, makes it easy to replicate an entire two-dimensional framework onto many separate pages, facilitating the modeling of alternative scenarios.

Much of the same functionality is available in Excel via workbooks and Version 4.0's new Scenario Manager add-in. But Borland's design is cleaner and easier to understand. Moreover, workbook files tend to be larger and more re-

*Spreadsheet vendors
will be adding more
and more advanced
analytical features to
their products.*

Suitability to Task: Spreadsheets

Spreadsheets are designed to handle a variety of chores. To help you determine which package is best suited to your needs, we tested the appropriateness of each program in the following six areas.

In **analysis and model building**, we look at the breadth and versatility of a program's function library. We also evaluate a program's precision, formula-writing and model-building tools, auditing features, data-management functionality, and computation performance.

Consolidation and linking evaluates the range of services that a program provides for building complex models out of subsidiary worksheets. Programs earning our top ranking are those that provide either full three-dimensionality or a command for consolidating disparate worksheets.

To evaluate a program's **charting**, we look at the number and quality of chart formats, the program's ability (or inability) to automate simple charting tasks, and whether the program allows users to customize charts with titles, notes, multiple typefaces, clip art, colors, and shading.

For **worksheet publishing**, we evaluate the ease and power with which a program allows users to

SUITABILITY TO TASK	
Product Name	POOR FAIR GOOD EXCELLENT
Analysis and model building	● ○ ○ ○
Consolidation and linking	● ● ○ ○
Charting	● ● ● ●
Worksheet publishing	● ● ● ●
Interoperability	● ● ● ●
Applications development	● ● ● ●

turn worksheets into boardroom-quality reports. Top scores go to programs that allow WYSIWYG editing; include a broad range of font, shading, ruling, and color options; support consistency with named styles; and offer an accurate print previewer.

Interoperability rates a program's ability to work with other spreadsheet file and macro formats, with emphasis on Lotus 1-2-3 compatibility. We also tested the program's ability to write to and query from databases and to a lesser extent, its availability on other platforms such as OS/2 and the Apple Macintosh.

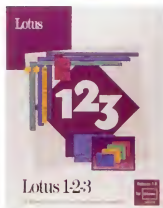
Applications development examines the extent and flexibility of a spreadsheet's macro language and its ability to produce screens, menus, icons, error handling, and help. We also look at debugging services and interfaces with other programming languages.



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EDITORS' CHOICE

source-consumptive than corresponding QPW notebooks. On the other hand, Excel's Scenario Manager has the ability to create a summary table—a valuable feature with no counterpart in QPW. (See the sidebar “Scenario Management: Who, What, When.”)

QPW's three-dimensional structure and notebook metaphor, along with a number of other unique attributes, suggest that in Windows, unlike DOS, the major spreadsheet programs will probably develop along very different paths and present clearly divergent choices to the end user.

So far, Lotus's entry in this arena appears to have been hamstrung by fealty to the great and sometimes crippling god of backward compatibility. 1-2-3 for Windows is a faithful port of 1-2-3, Release 3.x, right down to its ring-style menu trees. But apart from its customizable icon palette (a feature that has now made its way into Release 2.x and will undoubtedly appear in the next revision of Release 3.x as well), 1-2-3 for Windows does little to exploit the possibilities inherent in Windows.

WAITING IN THE WINGS

The odds are that this will change in 1993. Lotus is reputed to be pouring a massive research and development effort into 1-2-3 for Windows, Release 2.0. Given the reception that was accorded Release 1.0, it's fair to say that the company's reputation as developer of spreadsheet technology is on the line with Release 2.0. Look for something more innovative (and more solidly tested) in the next release of 1-2-3 for Windows.

Lotus's central problem—how to keep one foot firmly planted while moving the other boldly ahead—is no longer its alone. Microsoft now faces the same issue. The company has often indicated its intention to provide a BASIC-like macro language for all its applications, including Excel. But Excel's current language is anything but BASIC-like. Will Excel 5.0 incorporate support for three programming languages (BASIC, Excel's own macro language, and 1-2-3's macro language)? Don't lay a finger on that dial.

Whatever else may be coming our way in the near future, you can expect to see

- Microsoft Excel
- Quattro Pro for Windows

Our Editors' Choices are two superb Windows spreadsheets, each with its own personality and distinctive strengths. Microsoft Excel 4.0 is the analysts' choice, while Borland International's Quattro Pro for Windows 1.0 gets the nod for ease of use in three-

dimensional modeling and for presentation values.

Since its first release, Excel has always had the most powerful function library and the most sophisticated tools for building, auditing, and consolidating two-dimensional worksheet models. It's the only program that can automatically outline your models, present diagnostic error messages when formulas go awry, automatically consolidate worksheets that don't have identical row-and-column setups, and solve optimization problems that require integer programming. The latest release, with its advanced function set, new statistical commands, and brilliant crosstab generator, puts Excel even further ahead in terms of analytic power. Excel has also led the trend toward easier everyday functionality.

Those who prefer to work in three dimensions, however, will find Quattro Pro for Windows' notebooks a sharper tool than Excel's workbooks. The syntax for building cross-worksheet formulas is simpler in QPW, the user interface for reordering sheets and navigating between them is more straightforward, and the size of a many-page notebook file in QPW is less than that of a corresponding Excel workbook.

two current trends to continue. Spreadsheet vendors will be adding more and more advanced analytical features to their products. At the same time, these vendors will be searching for new ways to make all features great and small easier to use.

On both fronts, Microsoft is leading the way. Excel 4.0's new functions and

Presentation power has always been one of Excel's greatest strengths. But QPW, in its first release, has leapfrogged Excel in this department. With its bitmapped-graphic backgrounds, gradient fills, and easy slide-show facility, QPW comes closer than Excel to being serviceable as a presentation-graphics package. Excel's drawing layer makes it easier to use for freehand worksheet annotations, however, and Excel has more options for displaying text on the worksheet—including the ability to center text between columns.

For those who still live exclusively in the world of DOS, choices are more attractive than ever. Quattro Pro 4.0 is arguably the most versatile non-Windows spreadsheet ever, able to hold up to 32 worksheets in memory at once and endowed with sophisticated analytical graphing capabilities and flexible file-linking formulas (in lieu of true three-dimensionality). CA-SuperCalc 5.5, while not the easiest package to learn, offers true 3-D capability and extraordinarily rich graphing services at a bargain price. For those for whom Lotus 1-2-3 compatibility is a vital issue, 1-2-3 itself (now in Release 2.4) offers the best there is—plus a new “back-solver” add-in and an icon palette.

add-ins provide sophisticated tools for financial professionals, engineers, statisticians, and researchers. But Excel 4.0 has also broken new ground in the quest for easier everyday functionality. Excel's brilliant new ideas—drag-and-drop cell manipulation, automatic creation of numeric and label series, and one-step designer formatting—have already been



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adopted by the competition (see the sidebar "Three Easy Pieces").

LATEST AND GREATEST

This year's lineup of spreadsheets includes all the programs that underwent revision since our last review and that arrived in shrink wrap at PC Magazine Labs by August 15, 1992. The eight programs meeting these criteria are CA-SuperCalc, Version 5.5; InstaCalc, Version 4.0; Lotus 1-2-3 for DOS, Release 2.4; Lotus 1-2-3 for Windows, Release 1.1 (with SmartPak); Lucid 3-D, Version 2.5; Microsoft Excel, Version 4.0; Quattro Pro, Version 4.0; and Quattro Pro for Windows, Version 1.0.

Whether you're in the market for a first spreadsheet or simply an upgrade from your current program, a reasonable starting point is to determine what operating platform you want to use. Our review set includes three Windows products—Excel, 1-2-3 for Windows, and QPW—and five programs that run in DOS.

If DOS is your preference and your system has at least 2 megabytes of extended memory, you should also consider 1-2-3, Release 3.x. Lotus's advanced DOS spreadsheet was not included in this year's survey because it hasn't been revised since our last feature. (A Release 3.4, with enhancements parallel to those that appeared in the 2.3-to-2.4 upgrade, is rumored to be imminent.)

The next issue to look at is the degree of 1-2-3-compatibility you require. For maximum compatibility with 1-2-3, the sensible choice is 1-2-3. CA-SuperCalc, Excel, and both flavors of Quattro Pro all run 1-2-3, Release 2.x, macros without translation. But none of those programs support macro calls to Wysiwyg or other 1-2-3 add-ins.

2-D OR 3-D?

Next, you should consider whether you're going to want a three-dimensional spreadsheet. CA-SuperCalc 5.5 and all three of our Windows spreadsheets offer users three-dimensional modeling (Excel does so by way of its workbook feature), but for large multipage structures, QPW's notebook interface is the easiest spreadsheet to work with. On the other hand, 1-2-3 for Windows offers a greater degree of 1-2-3 compatibility and Excel

has a long list of countervailing features.

For budget-conscious buyers, this year's spreadsheet lineup includes three products in the under-\$150 range. InstaCalc (\$49) and Lucid 3-D (\$99.95) are both small-scale programs that can be run as DOS TSRs. But at \$149, CA-SuperCalc is the bargain of the lot, offering all the power of a \$495 spreadsheet at less than one-third the price. Read on for the details.

Computer Associates International Inc.

CA-SuperCalc

ALL REVIEWS

By CRAIG STINSON

Like Quattro Pro, CA-SuperCalc has made a career for itself by outgunning the market leader on features. In CA-SuperCalc's case, though, the original adversary was not Lotus 1-2-3 but one of the first compelling computer programs, VisiCalc.

CA-SuperCalc was born in the dark days of CP/M. According to legend, Adam Osborne wanted a spreadsheet for his little black machine, and Personal Software (the precursor of VisiCorp) wasn't willing to produce an uncopied-protected version of VisiCalc. (The CP/M market, unlike the Apple II and early DOS market, never tolerated copy protection.) CA-SuperCalc, commissioned to fill the gap, did its best to compete by offering such advanced features as individually adjustable column widths.

When 1-2-3 and the IBM PC knocked off VisiCalc and the Apple II, CA-SuperCalc hopped platforms and kept on gunning. Long before Lotus Development Corp. coined the term *backsolver*, the DOS version of CA-SuperCalc was offering goal-seeking, a full-featured auditor, and graphs that were far superior to 1-2-3's.

Recently, development efforts for CA-SuperCalc have slowed somewhat. The program's current

owner, Computer Associates International, has ignored the rush toward graphical editing screens, solvers, and other fancy stuff. The most decisive move that the company has made to improve CA-SuperCalc's competitive position has been to lower the price—to \$149.

JUST TEXT

CA-SuperCalc, Version 5.5, which was just released as this review went to press, is a text-mode-only spreadsheet. It runs 1-2-3, Release 2.x, macros without translation but does not know what to do with .FMT, .FM3, or .WK3 files. (It does import Release 2.x worksheets and Allways formatting files, however.) It does not support named styles, and it has no optimizer or print spooler. But it has plenty of other attractions.

CA-SuperCalc 5.5 is a three-dimensional spreadsheet that allows up to 255 files in memory (provided you have expanded memory). Each file can have up to 255 pages. Like 1-2-3, Release 3.1, the program lets you look at up to three pages or files at once, in fixed-position windows. Range names may be local to the page—a handy option that can simplify consolidation of non-identical sheets. Groups of files can be saved and reloaded under a "workspace" umbrella.

The program's function set, formatting options, and database functionality



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CA-SuperCalc's graphs come with unusual options, such as error bars.

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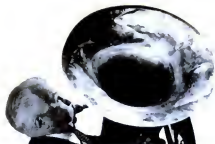
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386DX/33 w 486SX/25	Intel 80386DX-33 MHz or Intel 80486SX-25 MHz, with built-in 8K CPU cache	2 standard 32 max	80	as above	as above	\$999 \$37/mo*
486SX/25	Intel 80486SX-25 MHz Built-in 8K CPU cache	as above	80	1.2 & 1.44	16 bit SVGA card 14" 1024x768 SVGA Color Monitor	\$1,199 \$44/mo*
386DX/33 CACHE	Intel 80386DX-33 MHz 64K CPU cache	4 standard 32 max	120	as above	16 bit SVGA card & Hi-Color Support, 14" 1024x768 SVGA 28 Interlaced Color Monitor	\$1,399 \$52/mo*
486SX/33	Intel 80486SX-33 MHz 8K CPU cache	as above	120	as above	as above	\$1,499 \$56/mo*
486DX/33 CACHE	Intel 80486DX-33 MHz 128K CPU cache	as above	120	as above	16 bit SVGA card, 1MB Video RAM & Hi-Color Support, 14" 1024x768 SVGA Non-Interlaced Multisync Color Monitor	\$1,799 \$67/mo*
486DX/50 CACHE	Intel 80486DX-50 MHz 128K CPU cache True 50 MHz CPU	as above	120	as above	as above	\$1,999 \$74/mo*
486DX/66 CACHE	Intel 80486DX-66 MHz 128K CPU cache New Double Clock CPU	8 standard 32 max	200	as above	16 bit SVGA Superfast Windows Accelerator card, 1MB RAM, 14" 1024x768 SVGA Non-Interlaced Multisync Color Monitor	\$2,499 \$93/mo*

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CIRCLE 132 ON READER SERVICE CARD

Benchmark Tests: Spreadsheets

While Quattro Pro for Windows 1.0 performed well for a first release, Microsoft Excel 4.0 proved itself as one of the only spreadsheets capable of completely loading our largest test file.

WHAT THE NUMBERS MEAN

Quattro Pro for Windows performed quite well for a 1.0 release. Though slow on the File Load from Disk, File Save to Disk, and Program Load from Disk tests, it performed recalculations, sorts, and imports with the best of the spreadsheet programs. Except for its showing on the Program Load from Disk test, on which Microsoft Excel was considerably faster, OPW performed on a par with its more mature competitor. Lucid 3-D was a stellar performer on the File Load from Disk and File Save to Disk tests, but it could not complete the Mathematical

Recalculation and Financial Recalculation tests, and it did poorly on the Import Comma-Delimited ASCII File test.

Our Import Comma-Delimited ASCII File test uncovered an interesting quirk in all of the spreadsheets, except for the two entries from Borland International. Our file contained 10,000 rows of data. Only the Excel spreadsheet was large enough to load all 10,000 rows. All the other spreadsheets have 8,192 rows (except InstaCalc, which has only half that), as did the older Release 2.01 of Lotus 1-2-3 for DOS. All of the spread-

sheet programs appeared to load the entire file. Only the two Quattro Pros accurately reported that they were unable to complete the loading. The failure to report a file-loading problem is, in our opinion, a serious omission.

Lotus 1-2-3 for DOS, Release 2.4, was tested without the Wysiwyg add-in. With the Wysiwyg and SmartIcons add-ins loaded, there was not enough memory to load several of our test files. In this case anyway, spreadsheet publishing and performance are an either/or situation.

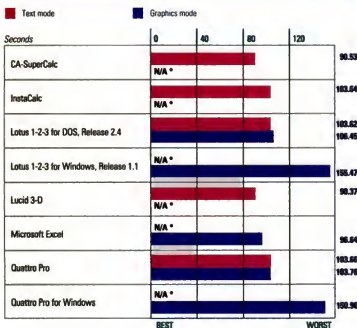
FILE LOAD FROM DISK



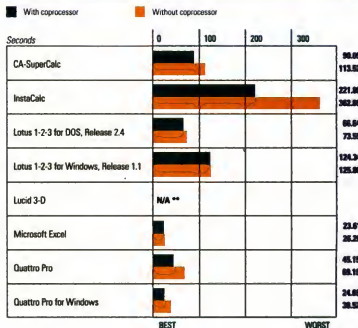
FILE SAVE TO DISK



SCREEN REFRESH



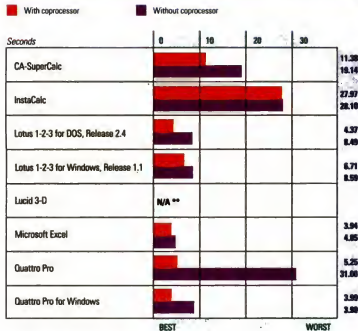
MATHEMATICAL RECALCULATION



N/A *—Not applicable: The product does not have this mode.

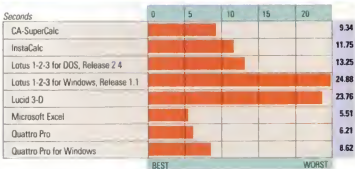
N/A **—Not applicable: The product does not complete this test.

FINANCIAL RECALCULATION

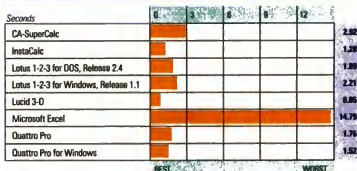


N/A **—Not applicable. The product could not complete this test.

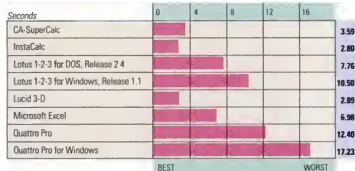
DATABASE SORT



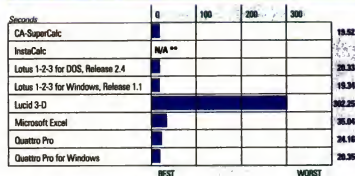
INSERT COLUMN



PROGRAM LOAD FROM DISK



IMPORT COMMA-DELIMITED ASCII FILE



N/A **—Not applicable. The product could not complete this test.

HOW WE TESTED

We tested all the spreadsheets in this review on a Compaq Deskpro 386/25e equipped with a 300MB hard disk and 8MB of RAM. Each machine ran DOS 5.0, and for the Windows spreadsheets, Microsoft Windows 3.1. All test files were generated in .WK1 format and imported into each program. Formulas were translated into the syntax of the program being tested, and the files were saved in the program's native format. Times are reported in seconds elapsed, and in all cases, a shorter time is better.

The **File Load from Disk** test measures the time it takes to load the Mathematical Recalculation file from disk. The **File Save to Disk** test measures the time it takes to save the same file to disk in the program's native format. The **Screen Refresh** test uses the Database Sort file to measure scrolling speed. We time how long it takes each spreadsheet product to scroll up and down through 50 screens. Both text and graphics modes are tested where applicable.

The **Mathematical Recalculation** test measures the time it takes a program to calculate a worksheet containing 1,456 mathematical operations. The test is run with and without a math coprocessor installed. The **Financial Recalculation** test calculates the net present value and internal rate of return for 253 different ten-year cash flows. This test is also run with and without a math coprocessor. The **Program Load from Disk** test measures how long it takes to load the spreadsheet program from disk.

The **Database Sort** test times a two-level sort on a database of 10,000 rows and 10 columns. The primary field is sorted in ascending order, while the secondary sort field is sorted in descending order. The **Import Comma-Delimited ASCII File** test measures how long it takes each program to import a 10,000-line comma-delimited file. The **Insert Column** test measures the time it takes to insert a column in our large Mathematical Recalculation file.

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FLAT-OUT-RELIABLE IBM PPS II

are comparable to those of 1-2-3, Release 2.x, and Quattro Pro. The graphing services, however, are extraordinary. Among the unusual options in the charting module are polar charts, text charts of up to three columns, error bars, "dual charts" (for example, a pie chart in which

SUITABILITY TO TASK

CA-SuperCalc

POOR FAIR GOOD EXCELLENT

Analysis and model building	●	●	●	○
Consolidation and linking	●	●	●	●
Charting	●	●	●	●
Worksheet publishing	●	●	○	○
Interoperability	●	●	○	○
Applications development	●	●	●	○

one slice is further analyzed by an accompanying pie-bar), and both linear and nonlinear (quadratic, cubic, or polynomial) curve fitting. CA-SuperCalc's charts can include up to 9,999 data series, and its x,y charts can have more than one x series.

Though the program doesn't show font choices, shading, or line drawings on-screen, it includes a graphic-mode print previewer. Version 5.5 of the program ships with three Bitstream fonts (Courier, Dutch, and Swiss) and lets you use up to eight combinations of font, size, and style per worksheet. The current version also adds print scaling, automatic scaling to fit a single page, and a handy

CA-SuperCalc is a powerhouse, and it's inexpensive. If you can live with the program's shortcomings, CA-SuperCalc is the value king of spreadsheets.

provision for assigning names to combinations of print settings.

AUDIT POWER

CA-SuperCalc's auditor is unmatched. Among its selection options are cells that contain invariant formulas, cells that result in a date or time value, cells that reference blank cells, cells unreferenced by other cells, cells that have entry-level (local) formats but are blank, unprotected cells, cells containing "output attributes" (shading, borders, or fonts), and cells containing printer control strings. You can also use CA-SuperCalc's auditor to ferret out named ranges whose definitions include cells beyond the active worksheet area, ranges that have more than one name, overlapping ranges, and other exotica.

The program's macro language is a superset of 1-2-3, Release 2.01's. Macros may be stored on the worksheet where they are used, on a separate library sheet, or in a separate ASCII file. A learn mode is included, as is an extensive debugger whose trace output can be redirected to a file or printer as well as displayed on-screen.

SUPER COMPLEXITY

CA-SuperCalc, in short, has thrived by providing options. But ironically, its wealth of features constitute a kind of liability: It has perhaps the most complex ring-style menu system in all of computerdom, including no fewer than 32 top-level menu options, many of which have five or more subordinate levels. Even the humble save command comes with four levels of suboptions. For the newcomer, CA-SuperCalc's command tree could

present a serious learning hurdle, despite the program's new mouse support and the continuing presence (recent events notwithstanding) of a 1-2-3-compatible subtree.

With its unusual feature set and heavy user interface, CA-SuperCalc is a real maverick. But it's a powerhouse, nevertheless, and it's inexpensive. For those who can live without on-screen graphics and don't mind spending time with the manual, CA-SuperCalc is the value king of spreadsheets.

FormalSoft

InstaCalc

InstaCalc, Version 4.0, from FormalSoft, is a small-scale spreadsheet aimed at three kinds of users: those who are particularly price-sensitive, those who need easy cut-and-paste with other DOS applications, and those who want to be able to import data files from Quicken 5.0 or Quicken for Windows.

At \$49, InstaCalc is the least expensive spreadsheet on our review list. Its list price is half of Lucid 3-D's and a third of CA-SuperCalc's. Like Lucid 3-D, the program can be operated either as a DOS

standalone or as a TSR. If you choose the latter mode, you get the convenience of fast context switching (press the configurable hotkey combination and you're instantly in



InstaCalc) plus the ability to cut blocks of cells from the spreadsheet and paste them into your foreground application—or vice versa.

A crucial difference between InstaCalc and Lucid 3-D is that InstaCalc, in TSR mode, swaps most of itself to disk or extended or expanded memory when you switch away from it. If you have a 286-based PC or better and you've installed an extended memory manager (such as Microsoft's HIMEM.SYS), the swap-out is instantaneous. If you don't have extended memory, you'll experience a short delay while InstaCalc saves itself on your hard disk. But either way, your available conventional memory is reduced by only about 11K while you're

FACT FILE

CA-SuperCalc, Version 5.5

Computer Associates International Inc.,
One Computer Associates Plaza,
Islandia, NY 11788-7000; 800-225-5224,
516-342-5224; fax, 516-342-5329

List price: \$149.

Requires: 512K RAM (640K recommended), 5.3MB hard disk space, DOS 3.0 or later.

In short: Inexpensive and powerful, CA-SuperCalc offers three-dimensional modeling, a wealth of charting options, a comprehensive auditor, a macro debugger, and many other unusual features. It operates in text mode only, however, and the complexity of its command tree makes it one of the more difficult programs to master.



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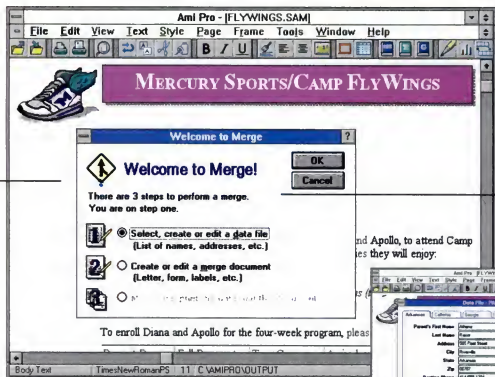
415/570-7700

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Foster City, CA 94404

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Ami Pro has a simple Merge dialog box that guides you step-by-step through the mail-merge process right on screen.

and Apollo, to attend Camp
es they will enjoy.

To enroll Diana and Apollo for the four-week program, please

The built-in mail-merge database lets you create address records that look... well, like actual file cards. And view them one at a time. This may be the only database program you'll ever need.



Adding, deleting, editing, or rearranging mail-merge "cards" with Ami Pro is simple and direct. To make things even easier, the "Insert Field" box naturally stays open until you're done entering new fields.

There's no question about it. New Lotus Ami Pro[®] 3.0 is not only technically superior to Microsoft[®] Word. It's also far simpler to learn and use.

Take Ami Pro SmartMerge[™] capabilities, for example. In easy-to-follow steps, Ami Pro guides you to effortlessly merged documents—even if it's your very first time. And only Ami Pro lets you preview and edit your merged document before you print. You can even choose to merge and print

several smaller documents (such as business cards or invitations) onto a single page. Or create a data file "link" from another application altogether.

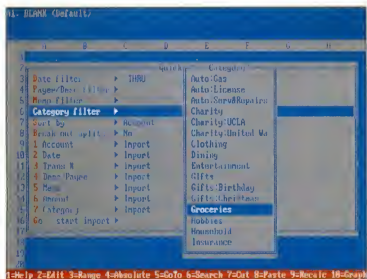
Ami Pro is the only word processor designed from the ground up for Windows[™]. And only Ami Pro 3.0 offers you unique features like a Style Sheet Viewer that lets you preview your Style Sheets before selecting. One-click SmartIcon[™] commands. A Clean Screen command that maximizes your

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Lotus Ami Pro 3.0 Word Processor for Windows

Development Corporation. *Offer expires March 31, 1993. Call for a list of eligible word processors. Education priced Lotus products not included. Not to be combined with Microsoft Word 2.0a using Windows 3.1. Ami Pro screens were created with Ami Pro 3.0 using Windows 3.1. Both were created using TrueType fonts.)



InstaCalc is the only spreadsheet program that directly imports data from Quicken.

at work in another program. This small footprint makes InstaCalc more serviceable than Lucid 3-D as a standby calculator.

On the other hand, InstaCalc can display only one spreadsheet file at a time. Worksheets may be linked by means of

expanded memory). You can allocate as much or as little memory as you please to your worksheets using a command-line switch (the default workspace is 40K). But if you need EMS, you have to run InstaCalc as a standalone.

InstaCalc also offers a shallower grid—4,096 rows to Lucid 3-D's 9,999. For most users, this difference will be irrelevant. But if you need to manage very

formulas, but you don't get the benefit of seeing two or more contexts at once. Lucid 3-D is stronger in this department, allowing you to keep as many as nine files in memory at once.

InstaCalc's TSR mode requires worksheet data to be stored in conventional memory (unlike Lucid 3-D's, which supports ex-

large lists, the relative shallowness of InstaCalc's grid could become an issue. On the other hand, Lucid 3-D includes a full set of database querying commands, including the ability to query external dBASE tables, as well as a command for performing distribution analysis.

INSTA-IMPROVEMENT

Version 4.0, introduced just as this issue was going to press, improves InstaCalc in

FACT FILE

InstaCalc, Version 4.0

FormalSoft, P.O. Box 1913, Sandy, UT
84091; 800-962-7118, 801-563-0971

List price: \$49.

Requires: 640K RAM, DOS 2.1 or later.

In short: InstaCalc is an inexpensive, small-scale spreadsheet package that can operate as a TSR. The newest version offers much better graphing than previous versions and can import data files from Quicken.



ON READER SERVICE CARD

The quickest way
between two points used to be
a straight line.

two areas. The program now includes its own graph module (earlier versions had only rudimentary graphics) supporting more graph types and including better printer support and more fonts. InstaCalc also imports Quicken data files (from both DOS and Microsoft Windows versions).

THE QUICKEN CONNECTION

The Quicken import routine, like the dBASE routine found in Version 3.0, lets you filter incoming records in a variety of ways. You can bring in just your Visa account data, for example, and refine it further to include specific categories such as type of expense, payee, or amount. InstaCalc automatically parses the information into rows and columns, allowing you to analyze, graph, or print.

FormalSoft had to reverse-engineer Intuit's file format, which is probably why InstaCalc is the only spreadsheet program offering this import option. Whether InstaCalc will be able to support future versions of Quicken remains to be seen.

*If what you need is
a simple spreadsheet
that can operate in
memory alongside
your word processor,
InstaCalc is definitely
worth a look.*

Graph types that come with the program now include three-dimensional bars, lines, and areas, and users can size and position charts on the printed page. (Version 3.0 was limited to dumping the graph screen to the printer.) Titles and floating text can be set in any of five different fonts, in point sizes ranging from 4 to 80. A mini-annotator lets you add lines and text to any part of the graph, and the chart itself can now be exported

to any of the following formats: .BMP, CGM, GEM Paint, HPGL, .PCX, PostScript, TIFF, and .WPG.

No one should mistake InstaCalc for a full-powered spreadsheet. The program has no regression capability, no publishing features, no "what-if" tables, and only a few of the model-building conveniences that have become standard equipment in the market-leading products. But if what you need is a simple spreadsheet that can operate in memory alongside your word processor, InstaCalc is definitely worth a look.

SUITABILITY TO TASK				
	InstaCalc			
	POOR	FAIR	GOOD	EXCELLENT
Analysis and model building	●	○	○	○
Consolidation and linking	●	●	○	○
Charting	●	○	○	○
Worksheet publishing	●	○	○	○
Interoperability	●	○	○	○
Applications development	●	●	●	○



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SUMMARY OF FEATURES

Spreadsheets



Products listed in alphabetical order

■ = YES □ = NO

	CA-SuperCalc	InstaCalc	Lotus 1-2-3 for DOS, Release 2.4	Lotus 1-2-3 for Windows, Release 1.1 (with SmartPak)	Lucid 3-D	Microsoft Excel	
List price	\$149.00	\$49.00	\$495.00	\$495.00	\$99.95	\$495.00	
Operating Environment							
LAN version available	■	□	■	■	□	■	
OS/2 version available	□	□	■	■	□	□	
Macintosh version available	□	□	■	■	□	■	
Uses LIM EMS 4.0	■	■	■	□	■	□	
Uses extended memory	□	□	□	■	□	■	
Uses disk-based virtual memory	□	□	□	■	□	■	
Uses Microsoft Windows	□	□	□	■	□	■	
Supports Object Linking and Embedding as client/as server	N/A	N/A	N/A	□□	N/A	■ ■	
Capacity							
Worksheet grid dimensions (rows x columns x pages)	9,999 x 255 x 255	4,096 x 256 x 1	8,192 x 256 x 1	8,192 x 256 x 256	9,999 x 254 x 1	16,384 x 256 x 1	
Maximum number of open files	255	1	1	256	9	Unlimited	
Hardware Support							
Supports math coprocessor	■	□	■	■	■	■	
Supports mouse	■	■	■	■	■	■	
Import/Export							
.DB	□□	□□	□□	■ ■	□□	□□	
.DBF	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	
.DIF	■ ■	■ ■	■ ■	■ ■	□□	■ ■	
.SLK	□□	□□	■ ■	■ ■	□□	■ ■	
.WB1	□□	□□	□□	□□	□□	□□	
.WKS	■ ■	■ ■	■ ■	■ □	■ ■	■ ■	
.WK1	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	
.WK3	□□	□□	□□	■ ■	□□	■ ■	
.WQ1	□□	□□	□□	□□	□□	□□	
.WR1	□□	□□	■ □	■ □	□□	■ □	
.XLS 3.x	□□	□□	□□	■ □	□□	■ ■	
.XLS 4.0	□□	□□	□□	□□	□□	■ ■	
Text-File Support							
Imports/exports tab-delimited files	□□	■ ■	■ □	■ ■	■ ■	■ ■	
Imports/exports comma-delimited files	■ ■	■ ■	■ □	■ ■	■ ■	■ ■	
User-defined delimiter	□	□	■	■	□	■	
Analytic Features							
Total number of functions:							
Math and trigonometric	20	26	17	17	17	64	
Date and time	18	13	11	13	9	19	
Statistical	12	9	7	10	8	70	
Financial	18	12	11	12	12	50	
Database statistical	9	None	7	11	None	16	
String	17	17	19	18	3	21	
Logic	18	6	9	10	11	19	
Total number of other built-in worksheet functions	36	18	12	12	11	56	
User can create custom functions	■	□	□	□	■	■	
Add-in function libraries	■	□	■	■	□	□	
Sensitivity tables	■	□	■	■	□	■	

N/A—Not applicable. The product does not have this feature.

▶ SUMMARY OF FEATURES

Products listed in alphabetical order



■ = YES □ = NO

	CA-SuperCalc	InstaCalc	Lotus 1-2-3 for DOS, Release 2.4	Lotus 1-2-3 for Windows, Release 1.1 (with SmartPak)	Lucid 3-D	Microsoft Excel
Analytic Features (continued)						
Matrix manipulation	■	■	■	■	□	■
Linear regression	■	□	■	■	□	■
Curve fitting	■	□	□	■	□	■
Goal seeker	■	■	■	■	□	■
Linear/nonlinear optimizer	□□	□□	□□	■	□□	■
Auditing Features						
Text annotations in formulas/as attached notes	■	□□	□□	■	□	■
Text annotations via drawing-layer text boxes	□	□	■	□	□	■
Sound annotations	□	□	□	□	□	■
User can select and display formula antecedents and consequents	■	■	■	□	■	■
User can trace through all elements of circular-reference chain	■	□	■	□	□	□
Map mode	■	■	□	□	□	□
Recalculation Abilities						
Natural	■	■	■	■	■	■
Intelligent	■	□	■	■	■	■
Manual	■	■	■	■	■	■
Background automatic	■	□	□	■	□	■
Automatic for active worksheet only	■	■	□	□	□	■
Database Features						
Search-and-replace	■	■	■	■	■	■
Sorts by row/column	■	■	■	■	■	■
Maximum number of sort keys	3	9	2	255	2	3
Joins two database tables	■	□	□	■	□	■
Queries external database files	□	■	□	■	□	■
Includes database entry screen	■	■	□	□	□	■
User can develop custom data-entry screen	■	■	■	■	□	■
Crosstab generation command	■	□	□	■	□	■
Frequency analysis commands and functions	■	■	■	■	□	■
Formatting and Publishing						
Text display mode	■	■	■	□	■	□
Graphics display mode	□	□	■	■	□	■
User can create named styles	□	□	■	■	□	■
User-definable numeric formats	■	□	□	□	■	■
Fractional formats	□	□	□	■	□	■
Displays negatives in parentheses	■	■	■	■	■	■
Value-dependent color settings	■	■	□	■	□	■
Aligns currency symbols and parentheses	■	□	□	□	□	■
User can customize currency symbols	■	■	■	■	■	■
Numbers can be centered or left-aligned	■	□	■	■	□	■
Displays formula text	■	■	■	■	■	■
Formatting cell by cell/sheetwide	□	■	■	■	■	□
Centered text across multiple columns	■	□	■	■	□	■
Multiline labels	■	□	■	■	□	■
Vertically oriented text in labels	■	□	□	■	□	■
Maximum number of fonts per worksheet	8	1	8	8	1	255

PC EDITORS' CHOICE
Quattro Pro for Windows

CONTINUES

Lotus will probably keep the 2.x series

FACT FILE

**Lotus 1-2-3 for DOS,
Release 2.4**

*Lotus Development Corp., 55 Cambridge
Pkwy., Cambridge, MA 02142; 800-343-
5414, 617-577-8500; fax, 617-253-9150*

List price: \$495.

Requires: 512K RAM, DOS 2.1 or later. 5MB hard disk space recommended.

In short: Lotus Development Corp.'s speedy spreadsheet is looking more and more like the no-frills selection these days. But it's still a great machine for everyday spreadsheet work.

 ON READER SERVICE CARD

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SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO



	CA-SuperCalc	InstaCalc	Lotus 1-2-3 for DOS, Release 2.4	Lotus 1-2-3 for Windows, Release 1.1 (with SmartPak)	Lucid 3-D	Microsoft Excel
Formatting and Publishing (continued)						
Bold and italic variants treated as separate fonts	■	□	□	□	□	□
User can name and reuse font sets	□	□	■	■	□	□
Maximum number of scalable fonts	3	N/A	4	13	N/A	N/A
Maximum number of bitmapped fonts	16	N/A	N/A	4	N/A	N/A
Line drawings and borders	■	□	■	■	□	■
Cells can be shaded	■	□	■	■	□	■
Automatic formatting capability	□	□	□	■	□	■
Worksheet can show geometrical shapes	□	□	■	■	□	■
Via drawing layer/superimposition of graph window	N/A	N/A	□ ■	□ ■	N/A	■ □
Graphs can be embedded on worksheet	□	□	■	■	□	■
Graphing						
Maximum number of series per chart	9,999	6	6	6	99	255
Maximum number of points per series	9,999	1,000	8,192	8,192	Unlimited	4,000
Maximum number of points per chart	Unlimited	6,000	49,152	49,152	Unlimited	32,000
User can specify multiple series as a single range	■	□	■	■	■	■
Automatically parses multiple series based on range shape	■	□	□	□	□	■
Two-dimensional chart types supported:						
Vertical bar	■	■	■	■	■	■
Stacked vertical bar	■	■	■	■	■	■
Horizontal bar	■	□	■	■	■	■
Stacked horizontal bar	■	□	■	■	■	■
Line	■	■	■	■	■	■
x,y	■	■	■	■	■	■
Area	■	■	■	■	■	■
Pie	■	■	■	■	■	■
Multiseries pie	■	□	□	□	□	□
Pie-bar (100% bar)	■	□	□	■	□	■
Radar	■	□	□	□	■	■
High-low-close	■	■	■	■	■	■
High-low-close-open	■	□	■	■	□	■
Combinations	■	□	■	■	■	■
Text	■	□	□	□	□	□
Other	None	None	None	Horizontal line	None	None
Three-dimensional chart types supported:						
3-D vertical bar	■	■	■	■	■	■
Vertical bar with each series in separate plane	□	■	□	■	□	■
Line (ribbon)	■	■	□	■	□	■
Area	■	■	□	■	□	■
Pie	■	■	□	■	□	■
Surface or wireframe	□	□	□	□	□	■
Other	None	None	None	None	None	None
User can scale any axis manually	■	■	■	■	□	■
Logarithmic scaling for x- and y-axes	■	□	□	■	□	■
User can customize spacing between bar markers	□	■	■	□	□	■
Allows floating text annotations	□	■	■	■	□	■

N/A—Not applicable. The product does not have this feature

CONTINUES

SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

PC EDITORS' CHOICE

	CA-SuperCalc	InstaCalc	Lotus 1-2-3 for DOS, Release 2.4	Lotus 1-2-3 for Windows, Release 1.1 (with SmartPak)	Lucid 3-D	Microsoft Excel
Graphing (continued)						
Can attach annotations to individual data points	□	□	■	■	□	■
Annotations with arrows or freehand drawings	□	■	■	■	□	■
User can assign scaling factor to data-point labels	□	□	■	■	□	■
Automatically staggers data-point labels	□	□	■	■	■	□
Automatically rotates data points	□	□	□	□	□	■
Axes can be suppressed	■	□	■	■	□	■
User can specify cross points for axes	□	□	■	■	□	■
Can display or suppress grid lines	■	■	■	■	■	■
Can switch between color and monochrome palettes	■	□	■	■	□	■
Gradient fills available	□	□	■	□	□	□
Data-point marker customization:						
Border	□	□	□	□	□	■
Fill	□	□	■	■	□	■
User can replace standard markers with bitmaps	□	□	□	□	□	■
User can customize chart background	□	□	□	□	□	■
User can replace chart background with bitmap	□	□	□	□	□	□
User can modify 3-D chart rotation, elevation, and perspective	□	□	□	□	□	■
Macros						
Includes macro recorder	■	■	■	■	■	■
Allows worksheet-independent macro libraries	■	■	■	■	□	■
Auto-load macros	■	■	■	■	■	■
Auto-close macros	■	□	□	□	□	■
Other event-triggered macros	□	□	□	□	□	■
Macros can create custom menus	■	■	■	■	□	■
Macros can create custom dialog boxes	■	■	□	■	□	■
Dialog editor	□	□	N/A	■	N/A	■
Macros can execute DOS commands	□	■	■	■	■	■
Macros can operate on records in external data files	■	□	□	■	■	■
Debugging features:						
Single-step trace	■	■	■	■	■	■
Conditional breakpoints	■	■	□	□	□	■
Watch variables	□	■	□	□	□	■
Low-level language interface	■	□	□	□	□	■
Add-in toolkit available	■	□	■	■	□	■
Model Building and Editing						
Offers true three-dimensional worksheets	■	□	□	■	□	□
Users can create named associations of 2-D sheets	■	□	□	□	□	■
Includes group-edit mode	□	□	□	■	□	■
Allows file-linking formulas	■	□	■	■	■	■
External reference formulas can use wildcards	□	□	□	□	■	□
User can freeze rows and columns as titles	■	■	■	■	■	■
User can hide rows/columns	□ ■	□ ■	□ ■	□ ■	□ ■	■ ■
User can hide whole worksheets or windows	■	■	□	□	□	■
User can split screen horizontally or vertically	■	□	■	■	■	■

N/A—Not applicable. The product does not have this feature.

► SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

CA-SuperCalc

InstaCalc

Lotus 1-2-3
for DOS,
Release 2.4Lotus 1-2-3
for Windows,
Release 1.1
(with SmartPak)

Lucid 3-D

PC
EDITORS'
CHOICEMicrosoft
Excel

Model Building and Editing (continued)

User can open two or more independently movable windows on a worksheet	■	□	□	□	■	■
Allows partial-row and partial-column insertions and deletions	■	□	□	□	□	■
Allows drag-and-drop copies and moves	□	□	□	□	□	■
Includes undo command	■	□	■	■	□	■
Includes command to repeat last action	□	□	□	□	□	■
Allows copying of formats only	■	□	■	■	■	■
Allows erasure of formats only	□	□	■	■	■	■
Automatic fill capability	□	□	□	■	□	■
User can set column width for widest entry	■	□	□	□	□	■
User can set row height for tallest entry	□	□	□	□	□	■
Includes outliner	□	□	□	□	□	■
User can create named scenarios	□	□	□	□	□	■
Includes spell-checker	□	□	□	□	□	■
Includes search-and-replace	■	■	■	■	■	■

Printing

Includes print preview	■	□	■	■	□	■
User can adjust margins	□	N/A	□	□	N/A	■
User can adjust column widths	□	N/A	□	□	N/A	■
Prints in background	□	□	■	■	□	■
Automatic page scaling	■	□	■	■	□	■
User can specify scaling factors	■	N/A	■	■	N/A	■
Supports multiline headers and footers	■	□	□	□	■	■
Worksheet range can be used as page heading	□	■	■	■	□	■
Can create libraries of named print settings	■	□	■	■	□	□
Can print with or without cell grid lines	■	□	■	■	□	■
Can print with or without worksheet frames	■	□	■	■	□	■
Prints in landscape mode	■	□	■	■	□	■
User can specify starting page number	■	■	■	□	□	■
Includes option to print formula text, with each cell on separate line	■	■	■	■	■	□

Security

Warns against file overwrite on save	■	■	■	■	□	■
Timed background backup option	■	□	□	□	■	□
Can create backup on save	■	■	■	■	■	■
Can hide cell contents	■	■	■	■	□	■
Can lock cell contents	□	■	■	■	■	■
Files can be password-protected	□	■	■	■	□	■

Other User Interface Issues

User can customize screen colors	■	■	■	■	■	■
User can display or suppress worksheet grid lines	□	□	■	■	□	■
Includes icons for common tasks	■	□	■	■	■	■
Customizable icon palettes	□	N/A	■	■	□	■
Movable icon palettes	□	N/A	□	■	□	■
Can display multiple palettes	□	N/A	□	□	□	■
User can create keyboard shortcuts for common commands without writing macros	□	□	□	□	□	□

N/A—Not applicable. The product does not have this feature.

Quattro Pro

PC EDITORS' CHOICE
 Quattro Pro
 for Windows

worksheet windows cannot be scrolled while the user works in a dialog box; dialog boxes themselves use standard Windows interface controls in totally non-standard ways; DDE link formats copied to the Clipboard don't include range names, so the resulting links are broken if the worksheet is rearranged; and so on.) Others are inherited from Release 3.1. (Named styles in 1-2-3 for Windows, for example, don't include numeric formatting, because in Release 3.1 numeric formatting is 1-2-3's concern, while fonts, borders, and shading are the province of *Wysiwyg*.)

SmartPak and the other free upgrades have performed effective damage control for Lotus, but the time is now ripe for a serious overhaul of 1-2-3 for Windows.

Lucid Corp.

Lucid 3-D

Lucid 3-D, from Lucid Corp., is a spreadsheet with two virtues: It's inexpensive (\$99.95), and it gives you the option of running it as a TSR. (Despite its name, three-dimensional worksheets are not among the virtues of the Lucid 3-D program. Each worksheet file is a two-dimensional grid.)

In memory-resident mode, the program lets you skip back and forth between your spreadsheet and whatever other DOS program you happen to be running. Unlike its TSR competitor *InstaCalc*, Lucid 3-D doesn't swap its own code to disk or extended memory when you switch to another program. Unless you use a third-party memory manager, memory claimed by Lucid 3-D is off-limits to other applications for the duration of your session.

Lucid 3-D has a number of ways to

FACT FILE

Lucid 3-D, Version 2.5

Lucid Corp., 101 W. Renner Rd., #450,
 Dallas, TX 75082-2017; 800-967-5550,
 214-994-8100; fax, 214-994-8103

List price: \$99.95; upgrade from any earlier version, \$49.95.

Requires: 210K of available conventional memory (146K if LIM EMS 4.0 is available), DOS 2.1 or later.

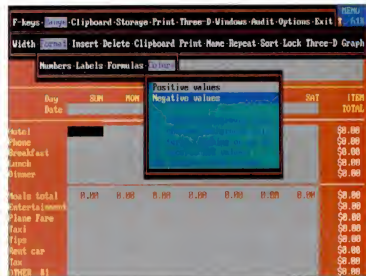
In short: In its optional TSR mode, Lucid 3-D offers convenient context switching and data transfer with other small-scale DOS programs. But its memory footprint is large, its functionality is less than that offered by most other spreadsheets, and its price is uncomfortably close to that of the powerful CA-SuperCalc, Version 5.5.



ON READER SERVICE CARD

deal with memory configurations, none of them optimal. In its default configuration, the program takes either 210K or 146K of RAM, depending on whether you have expanded memory. If LIM EMS 4.0 is available, Lucid 3-D will put all your worksheet data there, reducing the drag on conventional resources. If memory is tight, you can use a start-up switch to limit the amount set aside for your worksheet. Even in this minimum-footprint mode, though, the program needs 180K or 146K of RAM (again depending on EMS), and your worksheet size is restricted to 32K.

The RAM cram is exacerbated by the fact that Lucid 3-D requires additional



Lucid 3-D's ring-style menu shows all the levels of a command selection, helping you find your way to and from submenus.

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Automap

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The Intelligent Road Atlas is a unique software package that provides instant route planning and data profiles for over 51,000 cities in the U.S.A. and Canada. Search its massive database of over 359,000 miles of roads and highways for the fastest, most scenic or most convenient route to meet your needs. Automap #09514

Automap Europe

\$84

Planning a vacation in Europe? Get the software that's better than a map. Just tell AUTOMAP EUROPE where you're going, when and where you'll be starting, what areas you want to avoid, what you'd like to see on the way and what speeds you'd like to drive. This fast, fun and informative program takes over from there. Automap #10762

Chemistry Works

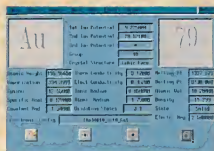
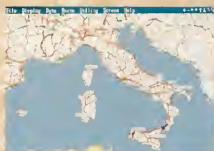
\$38

Get information about each of the chemical elements, from atomic weight to melting and boiling points. Plus, three-dimensional, color representations of atomic structures and elemental properties. Much more than a Computerized Periodic Table; CHEMISTRY WORKS is a comprehensive resource. Software Marketing #10756

Bodyworks

\$44

Make anatomy an adventure with this colorful, comprehensive program that guides you on a journey through the entire body. BODYWORKS brings advanced medical and anatomical information to your PC. It allows you to study all the structures, functions and systems of the body. It also includes detailed information on sports injuries, advice on illnesses, first aid and physical fitness information. This is a fascinating and useful program for anyone interested in the human body. Software Marketing #07324



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- Canadian customer orders, in most cases, delivered within 24 hours. Call for complete information.
- Competitive upgrades require proof of purchase of qualifying software.
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\$34



\$38

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Design Your Own Railroad

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Lotus Organizer

\$98

This is the next generation of Personal Information Managers from Lotus. Lotus Organizer gives you a Calendar with four formats, visual and audio alarms and more. The To-Do list lets you prioritize with color-coding. You also get an Address Book with mail-merge, a Notepad plus the speed of Autodialing. With Lotus Organizer on your side, a clean desk becomes a distinct possibility. Lotus #11193

NEW PRODUCT

\$52

WinDings

When it's time to round up your information in Windows, it's time for WinDings. The 5 applications included will help you get organized and save you time in the process. Show Your Cards is an automated Rolodex, World Scout is a detailed world map with local time and other worldly information. Howdy! lets you speed dial your phone. The Loan Arranger calculates information on any loan and O.K. Corral keeps all your personal information handy, from credit card numbers to frequent flyers. Application Techniques #11382

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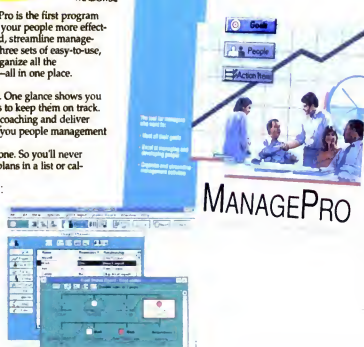
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Ace Software #07918



\$258

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Approach for Windows is the best-selling Windows database, as well as a winner of the "Best Software" award at Comdex, Spring 1992. The only do-it-yourself relational database for Windows, Approach is 100% compatible with dBase, Paradox and Oracle SQL. Produce desktop-published results using the built-in reportwriter, forms package and mailing label generator. Approach for Windows delivers unparalleled performance and is network compatible with no additional setup required. Includes 20 turnkey business templates like contact management, budgeting, payroll and more. Approach #11112

PC-Write



\$58

PC-Write for DOS

PC-Write is easy with its menus, mouse support, context-sensitive help, hint line and print preview. It's powerful, with its thesaurus, spelling-checker, ability to read and write WordPerfect files, proportional fonts, automatic reformatting and pagination, search and replace, headers, footers and mail merge. And it's adaptable, with its ability to add and delete features, change screen colors, set defaults and record macros. Quicksoft #07711

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CA-Texnor



CA-Texnor

Any word processor gives you a spell checker and thesaurus, but CA-Texnor goes further. It incorporates drop-down menus, pop-up dialogs, a user-configurable tool bar, user-defined folders and an advanced search function which immediately locates and retrieves specified text. You also get full editing capabilities in both WYSIWYG preview and draft mode, an advanced table editor and much more. And it's all easy to learn and use. Computer Associates #10715

TSR modules for graphing and file conversion. The graph component adds 70K to the load, while the file converters consume about 10K apiece (Lucid 3-D comes with four—for comma-delimited, dBase, Accounting, dBASE, and Lotus files). You can pop these modules in and out of memory as needed, using DOS command-line switches. But even with only the basic spreadsheet on board, your task-switching options are pretty limited. Don't expect to run Lucid 3-D in the background while you use a full-scale word processor or database manager.

SUITABILITY TO TASK

Lucid 3-D

POOR FAIR GOOD EXCELLENT

Analysis and model building	●	○	○	○
Consolidation and linking	●	●	●	○
Charting	●	○	○	○
Worksheet publishing	●	○	○	○
Interoperability	●	○	○	○
Applications development	●	●	○	○

When running in TSR mode, Lucid 3-D gives you considerable reward—the ability to cut and paste text between your spreadsheet and another application.

PASTEABILITY

But if you can make all the pieces fit, Lucid 3-D in TSR mode gives you one considerable reward—the ability to cut and paste text between your spreadsheet and another application. Microsoft Windows users take this kind of interapplication transfer capability for granted, but in the world of DOS spreadsheets, it's normally a pain.

Like InstaCalc, Lucid 3-D pays for

transfer convenience by eliminating some of the functionality available in other spreadsheets. The big dropouts are database management and presentation features. Although Lucid 3-D can sort lists (on two keys, by row or column), it has no querying capability beyond simple search-and-replace, no frequency analysis, and no regression analysis. As for presentation, there is virtually none. This is strictly a one-font, one-size number cruncher in the grand tradition of Lotus 1-2-3 prior to Allways.

The graphics component of Lucid 3-D has been improved slightly in the current version of the program. New chart types such as area, scatter, stacked area, and x,y charts have been added, along with horizontal variants of all types. But the program still lacks such commonplace charting amenities as the ability to scale axes manually and annotate data points.

LUCIDITY

On the plus side, Lucid 3-D lets you open as many as nine worksheet windows,

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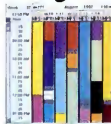
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some of which may be used for multiple views of the same worksheet. (InstaCalc, for instance, allows users to open only one window at a time.) A file-linking mechanism lets you create consolidation worksheets or large-scale models built from bite-size components. Lucid 3-D's built-in function set is adequate for everyday business math, the macro language is robust and includes user-defined function capability, an auditor is available, and recalculation speeds are superb. The program also offers rudimentary mouse support and comes with a handy notepad and calculator, each in a pop-up window.

On a functionality-per-dollar basis, though, Lucid 3-D doesn't stand up well in the current market of spreadsheet packages. The program is twice as expensive as the comparably featured InstaCalc and only \$50 less than the very richly endowed CA-SuperCalc 5.5. If you need TSR convenience and can live with the limitations, give Lucid 3-D a look. But check out the closely positioned competition as well.

Microsoft Corp.

Microsoft Excel

Microsoft Excel's days of being the only bright kid on the block are over. A strong competitor from Borland International has moved in, and a credible challenger from Lotus Development Corp. is almost



certainly on the way. But the \$495 Excel still has plenty of qualities that are unmatched by any other spreadsheet in any operating environment.

In particular, Excel remains the premiere analytic tool. Excel has always had a richer function set than Lotus 1-2-3 or Quattro Pro, including functions for performing regression and trend analysis, constructing "what-if" tables, and manipulating matrices. In other programs, these operations are implemented as menu commands. Excel's

Microsoft Excel remains the premiere analytic tool. Its advanced functions include financial analysis, engineering, calendar arithmetic, and statistics.

approach lets you analyze several sets of data on the same worksheet and see where the numbers came from. Excel's macro language also allows users to create their own custom functions.

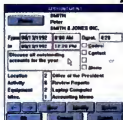
Excel is also the only spreadsheet that includes an outline and a spell-checker, both features that, so far, have drawn no imitators. You can use the outline to design the spreadsheet or let Excel use the structure of your model to find the appropriate hierarchical levels automatically. By clicking on buttons you can see what-

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CIRCLE 361 ON READER SERVICE CARD

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ever level of detail you need. For example, if your worksheet has monthly inputs rolled into quarterly totals, with a year-to-date column at the end, you can tell the outliner to show just the YTD numbers, the quarterly numbers plus the YTD numbers, or the entire model.

**Microsoft Excel 4.0 is
the only spreadsheet
that includes an
outliner and a
spell-checker.**

AN ANALYTIC EYE

With Version 4.0, which shipped last April, Microsoft Corp. extends Excel's analytic lead. The program now includes four categories of advanced functions (financial analysis, engineering, calendar arithmetic, and statistics), the Analysis Toolpak, a faster Solver that includes integer programming, and a crosstab generator. All these new items have been implemented as add-ins (to keep the size of the .EXE file within reason and to avoid burdening users who don't need the specialized features).

But unlike the typical add-in for 1-2-3, Release 2.x, Microsoft's add-ins are completely integrated into the core program's user interface. Once installed, the new functions are available from anywhere in the program, and the new commands simply attach themselves to the core menus. (An add-in manager lets you specify an auto-attach list.)

Addressing a major weakness of earlier versions, the latest revision also adds a 1-2-3 macro interpreter. Macros written

■ Three Easy Pieces

by Craig Stinson

Three great usability ideas are likely to become standard components of all Windows spreadsheets from now on. First introduced by Microsoft Corp. in Microsoft Excel 4.0, Borland International has already implemented versions of all three in Quattro Pro for Windows 1.0, and Lotus Development Corp. incorporated two of them in the recently shipped SmartPak add-in for Lotus 1-2-3 for Windows. The three ideas are drag-and-drop cell manipulation, automatic series creation, and one-step block formatting.

DRAW-AND-DROP

In Excel and QPW, you can now move and copy cells with the mouse, rather than having to use menu commands. When you position the mouse on the border of a cell or selected range in Excel, the pointer shape changes from a cross to an arrow. At that point, if you want to move the selection, just drag it. If you want to copy it, hold down the Ctrl key while you drag. In QPW, you can drag and drop a range of cells without having to position the mouse on the range border first. The trade-off for this simpler procedure is that you can't drag single cells.

In addition to copying and moving, Excel lets you insert, delete, and clear cells by direct manipulation. These maneuvers aren't available in QPW.

AUTOFILL

Excel's AutoFill feature makes creating time-series column headings a snap. The program displays a small black square, called a fill handle, at the lower right corner of the current cell or range. Drag the handle in any direction, and Excel performs an intelligent extension of whatever's currently selected. If the selection is January, for example, and you drag across the next 11 cells to the right, you get headings for each month of the year. If the selection is Quarter 1, you get Quarter

2, Quarter 3, and so on. You can create numeric series, as well; Excel simply extrapolates whatever you start with.

QPW and 1-2-3 for Windows have both picked up on the AutoFill idea. But both of these products require that you select the range to be filled first, then click on an icon or choose a menu command.

FORMAT POWER

Excel's AutoFormat feature borrows from the playbook of many presentation graphics programs. Excel comes with "designer" formatting combinations that can be applied like templates. Some are flamboyant, and some are plain; some are suitable for color displays, while others help you get the most out of your black-and-white printer. When you select any cell in an occupied range and choose the AutoFormat command, Excel presents a dialog box listing the format combos by name and showing samples of each. Your choice is automatically applied to the entire range, not just the current cell.

QPW and 1-2-3 for Windows both have comparable features, but both make you select the entire range before formatting. And neither of the competitors' commands is quite as intelligent as the original. Excel's command recognizes summary rows and columns and automatically gives them a contrasting format. QPW and 1-2-3 for Windows simply assume that the outer rows and columns of your selection should get special treatment, and they make you override that default if it's inappropriate.

On the other hand, QPW provides half as many formats as Excel and gives them the names of famous composers. The whimsy of formatting your budget with Puccini or Scarlatti is delightful. But whoever at Borland chose the name Wagner for a monochromatic formatting combination needs to visit the opera house. □

SUITABILITY TO TASK

Microsoft Excel

POOR FAIR GOOD EXCELLENT

Analysis and model building	●	●	●	●
Consolidation and linking	●	●	●	●
Charting	●	●	●	●
Worksheet publishing	●	●	●	●
Interoperability	●	●	●	●
Applications development	●	●	●	●

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CIRCLE 235 ON READER SERVICE CARD

Facts.

This Microsoft ad on the left has a lot to say about their spreadsheet, Microsoft® Excel. It also has a lot to say about *our* spreadsheet, 1-2-3. But before you believe their ad, ask yourself "What are the facts and what's just hype?"

According to their ad, Microsoft Excel will read and write all your Lotus® 1-2-3® spreadsheet files and run your 1-2-3 macros unmodified. Well, that'd be very impressive—if it were all true. But the fact is, Excel *can't* read Always files; or preserve formulas containing a 3D range; nor can it convert some WK3 files to Workbooks; and it certainly can't run 1-2-3 macros containing commands from versions after Release 2.01.

Now, the ad on the left also tells you that a 1-2-3 user need only type in a 1-2-3 command and Excel will show the equivalent command. Wrong, again. Excel only supports 1-2-3 Release 2.01 commands. In fact, Excel can't execute your familiar commands from Releases 2.2, 2.3, 2.4 and 3.1. Try pressing */, Range, Search* in Excel and see what happens. Absolutely nothing.

The fact is, if you're a DOS spreadsheet user, only 1-2-3 for Windows makes sense.

If you're a 1-2-3 user, you've created and saved hundreds of 1-2-3 files, styles and macros. It would certainly simplify your life if you could continue to use them, wouldn't it? Well, any 1-2-3 for DOS file, style or macro can be read and executed by 1-2-3 for Windows. And only 1-2-3 for Windows™—with its built-in Classic® Menu—lets you use your familiar 1-2-3 commands. Plus, only 1-2-3's 3D technology gives you easy access to 256 Worksheets and lets you build true 3D formulas. In comparison, Excel's Workbook offering is a limited imitation of true 3D. Try opening a large 1-2-3 3D file in Excel and see what happens. If you're lucky, it will work. So for the 1-2-3 for DOS user moving to Windows, why would you use anything but 1-2-3?

The fact is, the new 1-2-3 for Windows is better than ever.

The latest release of 1-2-3 for Windows now includes performance enhancements. (For example, it's now the fastest Windows spreadsheet for printing on PostScript® printers. It's also the fastest to launch.) We've also added over 25 innovative new features, usability enhancements and new programming tools. New features include: customizable SmartFill which lets you create custom lists such as sales offices, department names, employee lists, etc. and use them again and again (a feature not found in Excel); SmartFormat, which gives you pre-defined table formats; 3D SmartSum for summing up columns or rows across and through your 3D worksheets; and the ability to create custom GUI-style dialog boxes. The result—1-2-3 for Windows is now one of the most powerful and easy-to-use spreadsheets ever developed.

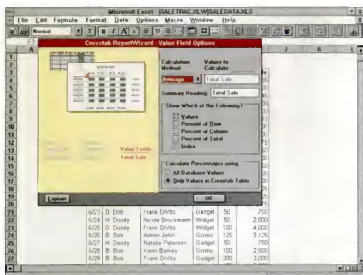
And, if you're a spreadsheet user who needs to access external databases, 1-2-3 for Windows remains unmatched—particularly if you need relational capabilities. The fact is, Excel's data access capabilities rest on a third-party product that offers limited relational capabilities. Which explains why Corporate Computing (August 1992) recently wrote that "for the experienced 1-2-3 database user, 1-2-3 for Windows with DataLens® is the front-end tool of choice."

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Lotus 1-2-3 for Windows



Microsoft Excel's new Crosstab ReportWizard makes it simple to analyze database records. As shown in the screenshot above, ReportWizard is about to create a table showing the average total sale for each salesperson and each product.

for 1-2-3, Release 2.x, can now be run without translation in Excel. An [XLCALL] statement, furthermore, lets you embellish imported Lotus macros with code written in Excel's own macro language.

Excel 4.0's new calendar functions simplify tasks that are awkward to perform with traditional spreadsheet methods. So, for example, the EDATE function returns the serial number of a date a specified number of months before or after some other date. WORKDAY returns the serial number of a date that falls a specified number of working days ahead or behind another date. NETWORKDAYS returns the number of whole working days between two dates.

The new financial functions in Excel include both widely applicable items (for example, FVSCHEDULE, which calculates the future value of an investment given a schedule of changing yields) and items of interest only to specialists (for example, MDURATION, which returns the Macauley modified duration for a security with an assumed par value of \$100). The engineering category includes unit-converting functions and functions for performing imaginary and complex-number arithmetic. Other new functions let you round numbers to multiples other than 1, calculate least common multiples and greatest common divisors, find the

integer portion of a division, and more.

TOOLS APLENTY

The Analysis Toolpak, meanwhile, includes commands that let you generate random numbers meeting various nonuniform distributions, create frequency tables and histograms, produce rank-and-percentile tables, generate moving

averages (with and without exponential smoothing), extract random and periodic samples from a data set, generate a table of descriptive statistics, and perform a variety of standard statistical tests.

Crosstab ReportWizard takes all the hard work out of cross-tabulating Excel databases. With it you can, for example, take a database of financial transactions and quickly turn it into a table organized by expense category and subcategory in the row dimension and time periods in the column dimension. You can add subtotals in either dimension and aggregate the data with any of the standard statistical functions, such as SUM and AVERAGE. Excel automatically applies its outliner to the resulting table, so you can

easily pop in and out of any level of detail. To top it all off, if you want to see the individual records behind any aggregate value, all you need to do is double-click on the aggregate cell; Excel goes back to the database, does a quick extract, and presents each relevant record in a new table.

In addition to these analytic features, Excel offers a host of conveniences for building formulas and models. While you enter or edit formulas, for example, it uses boldface characters to show exactly which parentheses are paired. If you forget what arguments a function requires, you can press the Ctrl-A key combination

Microsoft Excel's vulnerabilities currently lie in the areas of consolidation and presentation.

in the middle of a formula and Excel will tell you. If you need to copy a portion of a formula to another cell, you can use the copy and paste commands while you're on the formula bar (Quattro Pro for Windows also offers this convenience). If you wonder how a particular formula result was arrived at, you can simply double-click on the number; Excel responds by selecting all of that formula's precedent cells.

Excel, moreover, is the only spreadsheet available today that lets you reference cells by the names of their row and column headings. For example, if you name column D "March" and row 5 "COGS," then you can reference cell D5 as "March COGS."

CHINKS IN THE ARMOR

Excel's biggest areas of vulnerability currently lie its consolidation and presentation.

The program includes a name-based Consolidate command that rolls up subsidiary worksheets on the basis either of cell position or row-and-column headings. Though powerful and versatile, the

PC

FACT FILE

Microsoft Excel,
Version 4.0

*Microsoft Corp., One Microsoft Way,
Redmond, WA 98052; 800-426-9400, 206-
828-8080; fax, 206-936-7329*

List price: \$495.

Requires: 2MB RAM, 5MB hard disk space, Windows 3.0 or later, 4MB RAM, 10MB hard disk space, mouse recommended.

In short: Still the premier analytic spreadsheet, Microsoft Excel is full of great features that simplify the building of formulas and models. Its latest version adds direct support for Lotus 1-2-3 macros, an easy-to-use crosstab tool, an extensive set of specialized functions, import/export support for Lotus WYSIWYG formatting, and a close approximation of three-dimensional worksheet modeling.

ON-READER SERVICE CARD

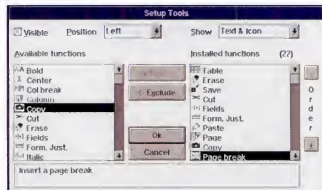
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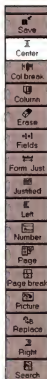
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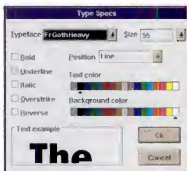
Decide where the tool bar appears on your screen.

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CIRCLE 348 ON READER SERVICE CARD

command is complicated. Version 4.0's new workbook feature brings a form of three-dimensionality to Excel, but users who like to work in multiple documents will find Quattro Pro for Windows' ap-

*Excel faces a
strong competitor
from Borland,
while a credible
challenger from
Lotus is almost
certainly on the way.*

proach much more satisfactory. Excel's workbook files tend to be considerably larger than corresponding QPW notebooks. Both the user interface for manipulating workbooks and the syntax for referencing ranges that span workbook components lack the elegant simplicity of QPW.

Presentation is still one of Excel's strong suits. If you're looking for presentation graphics, Quattro Pro for Windows does it better—offering more color options (including gradient fills), bit-mapped backgrounds, and a fully functional slide-show utility. But if you are interested in annotating worksheets with text and arrows, Excel's drawing layer is superior.

On the bottom line, Microsoft Excel is simply a colossal spreadsheet program. And the new competition coming from other spreadsheet vendors is only going to make it better.

Borland International Inc.

Quattro Pro

On the DOS side of the great divide, the most versatile spreadsheet you can buy is Borland International's Quattro Pro 4.0. The \$495 Quattro Pro has made its way in the world by being as Lotus 1-2-3-compatible as a program could dare to be (altogether too compatible, in the opinion of Lotus Development Corp.'s legal department), while con-

sistently outgunning 1-2-3 on features and maintaining parity on performance.

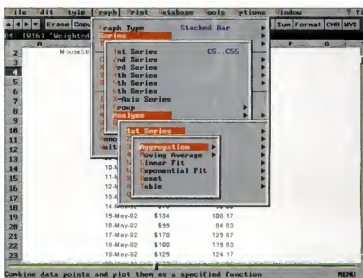
At its debut in 1989, Quattro Pro won market share by offering built-in publishing features, superior graphics, useful extensions to 1-2-3's function library and macro language, an optional Lotus-mimicking menu tree, a macro debugger, and the ability to run on modest hardware. Since then Lotus has countered much of this onslaught, but Borland keeps countering back. The latest version, introduced last February, has turned the competitive burner up a notch by providing the biggest boost yet to Quattro Pro's feature set.

Quattro Pro is a two-dimensional program that can handle up to 32 worksheets in memory at once. Users can toggle between two display modes—a character-oriented windowing interface, in which files can be tiled, zoomed, or overlapped, and a graphics-mode display that shows the effect of fonts, rules, and shading. A mouse palette, available in both modes, provides quick access to often-used commands; among other things, it includes a summation button, a button to adjust column widths so they accommodate the widest entries, and a button to switch display modes. Users can customize the palette by linking their own macros to buttons.

Although the program lacks the consolidation convenience offered by true three-dimensional spreadsheets, it does allow flexible file-linking formulas (such formulas can even reference external files by wildcards) and includes a command to save groups of files under a "workspace" umbrella.

EASY PRO-FORMANCE

Making everyday spreadsheet functionality easier is the dominant theme in



Quattro Pro's "analytic graphing" features let you aggregate values, calculate moving averages, and plot regression lines, without requiring you to enter formulas.

the Microsoft Windows market. But in Quattro Pro 4.0, Borland showed how it can be done with a DOS product as well. The latest version offers a set of "analytic graphing" commands that let users perform commonplace transformations on raw data.

These commands, for example, let you automatically generate moving averages or plot the curve or line that best fits a scattergram. You can also take data from one time series and aggregate it into another—converting, for example, daily sales numbers into monthly averages. None of this requires conventional spreadsheet formulas; the program presents you with a series of menu options

FACT FILE

Quattro Pro, Version 4.0

Borland International Inc., 1800 Green Hills Rd., P.O. Box 660001, Scotts Valley, CA 95067; 800-331-0877, 408-461-9122

List price: \$495.

Requires: 512K RAM, DOS 2.0 or later.

In short: Quattro Pro offers full Lotus 1-2-3, Release 2.x, compatibility, the ability to work with up to 32 two-dimensional files in memory, rich file-linking features, integrated publishing features, innovative analytical graphics, a full battery of business charts, a slide-show utility, an optimizer, an auditor, a macro debugger, and many other attractions.



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Other charting improvements introduced in 4.0 include bubble graphs—x, y charts in which each point is surrounded by a circle scaled to reflect the point's coordinate on a third data series—and zoom and pan. The latter feature lets you magnify an area of a chart and turn it into a separate chart.

For the benefit of users who wrestle with resource-allocation problems, Quattro Pro now includes an optimizer. This module, a version of Frontline Systems' What-If Analyst add-in for 1-2-3, uses linear and nonlinear programming techniques to find combinations of worksheet inputs that produce an optimal effect on a designated target cell while meeting specified constraints. (A nearly identical optimizer, from the same third-party source, is bundled with Microsoft Excel and Quattro Pro for Windows. Comparable functionality is included in Lotus 1-2-3 for Windows and 1-2-3, Release 3.1+, but not 1-2-3, Release 2.4.)

PRESENT AND ACCOUNTED FOR

On the presentation front, Version 4.0 now offers on-the-fly font scaling using Bitstream technology, thereby eliminating the font-building delays that irritated

4.0 also permits you to define custom display formats. The options are less extensive than they could be (unlike Excel's custom formats, for example, Quattro Pro's can't specify a numeric scaling factor), but they're valuable nevertheless. You can use them to include unit text beside numbers, display dates in a fully spelled-out form (complete with weekday names), force leading zeros, assign fill characters for check-writing purposes, and more.

Background printing is now available with the help of a separate utility program. This TSR uses about 18K of memory, spools print jobs to disk, and lets you monitor and manage its queue via a special window (somewhat like Quattro Pro's File Manager window). NetWare users can also specify any network print queue as the default output device and monitor and manage jobs spooled to that queue.

Workers in multivendor environments will welcome the new import (but not export) support for the Lotus publishing formats .ALL, .FMT, and .FM3. And users of all stripes can now take advantage of the program's auditor module, which displays formula-dependency and circular-reference diagrams, spots formulas that mistakenly reference labels or blank cells, summarizes worksheet linkages, and more.

HARDWORKING SHEET

On the worksheet, Quattro Pro offers a handful of other modest conveniences not found in the competition: block insertions and deletions, the ability to annotate named ranges, password protection that can be applied to formulas only (global protection is also available, as in other programs), the ability to sort by column as well as by row, and the ability to copy formatting attributes separately from cell contents and vice versa. For those who want their spreadsheet to be a presentation graphics program, Quattro Pro even offers an integrated slideshow utility, complete with ad hoc branching and transitional effects.

Quattro Pro's biggest weakness relative to 1-2-3 is its lack of third-party add-in support. Borland has addressed this issue by creating an add-in toolkit (available at no charge, the kit also allows C and C++ programmers to create custom

functions) and has tried to prime the pump with an extra-cost Financial @analyst package for \$49.95 (a set of functions for performing complex date arithmetic, cash-flow analysis, amortization and yield calculations, and probability analysis). But whether the market will ever bestow on Quattro Pro the level of support it has given 1-2-3 remains to be seen.

In response to the summary judgment

*For those who do 2-D
work and prefer DOS,
Quattro Pro remains
the best grid in town.*

in its legal battle over copyright infringement with Lotus Development Corp., Borland has removed 123.MU from Quattro Pro 4.0. That means that users no longer have the option of installing a 1-2-3-compatible menu tree. Macros written for 1-2-3, Release 2.2, will still run in Quattro Pro, however, provided they don't make calls to Lotus add-ins, such as Allways or Wysiwyg.

Users who need a three-dimensional spreadsheet will want to look elsewhere—to CA-SuperCalc 5.5, 1-2-3, Release 3.1+, 1-2-3 for Windows, or Borland's own Quattro Pro for Windows. Those who want the most in model-building power and charting convenience (and who have the requisite hardware) should check out the best of the current Windows programs—Excel and QPW—or wait until Lotus delivers Release 2.0 of 1-2-3 for Windows. But for those who do two-dimensional work and prefer DOS, Quattro Pro remains the best grid in town.

Borland International Inc.

Quattro Pro for Windows

No one should accuse Borland International's first Microsoft Windows spreadsheet of being imitative. While the \$495 Quattro Pro for Windows 1.0 offers three-dimensional modeling and runs Lotus 1-2-3, Release 2.3, macros without translation (custom Impress and Allways commands are not supported), it derives

SUITABILITY TO TASK	
Quattro Pro	
	POOR FAIR GOOD EXCELLENT
Analysis and model building	● ● ● ●
Consolidation and linking	● ● ● ●
Charting	● ● ● ●
Worksheet publishing	● ● ● ●
Interoperability	● ● ● ●
Applications development	● ● ● ●

users of earlier versions. Shipped in the box are five families of scalable fonts (Cooper Black, Courier, Dutch, Slate, and Swiss), as well as 11 bitmapped fonts; the latter include exotic items such as Old English and are suitable primarily for large headings.

Like 1-2-3, Release 2.4, Quattro Pro also now allows you to encapsulate combinations of formatting attributes as named styles. Among other virtues, this feature provides a way to work around the eight-font-per-worksheet limit of Version 3.0. Unlike 1-2-3, Quattro Pro

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nothing of importance from Lotus 1-2-3 for Windows. And while, like Microsoft Excel, it is extremely strong in the areas of presentation and application development, QPW has a personality entirely its own. This newcomer, in short, commands respect for both power and originality.

A QPW spreadsheet file, which Borland calls a notebook, consists of 256 row-and-column grids. Page tabs appear along the bottom of the document window to facilitate navigation. To get from page A to page D, for example, you simply click on the D tab. At the back of the notebook, on a special "graphs" page,

QPW stores icons for each graph you create, as well as for any of your application's custom dialog boxes or slide shows. Macro code resides within the worksheet file, on normal worksheet pages. A library option, similar to the one in Quattro Pro, Version 4.0, lets you make a worksheet's macros available to all other files in memory.

Page tabs serve other purposes besides navigation. To copy or move data to a new page, you can simply click on the appropriate tab when prompted for a destination. To move pages around in

SUITABILITY TO TASK				
Quattro Pro for Windows				
	POOR	FAIR	GOOD	EXCELLENT
Analysis and model building	●	●	●	○
Consolidation and linking	●	●	●	●
Charting	●	●	●	●
Worksheet publishing	●	●	●	●
Interoperability	●	●	●	○
Applications development	●	●	●	●

a notebook, you drag and drop the tabs. To assign properties to an entire page, you start by right-clicking on its tab.

WHAT'S IN A NAME?

Unlike any other 3-D spreadsheet program, QPW lets you name its pages and segregate your distinct modeling areas. The names replace letter designations on the notebook tabs, letting you see the structure of your file at a glance. More important, you can use the names in for-

■ Scenario Management: *Who, What, When*

by Craig Stinson

Spreadsheet programs were invented to solve "what-if" problems: Change an input and see what happens to an output. Later programs added "back-solving," or goal-seeking, capability. With a backsolver, you could reverse the what-if process—decide what value you wanted an output to assume, and the program would determine the appropriate input value.

Further advances in spreadsheet technology have brought us optimizers, or solvers. With an optimizer, you can set a target value at one cell, then specify both multiple input variables and multiple constraint cells. The optimizer finds all the combinations of input values that achieve the target output without violating the constraints. Or, more typically, you might tell the optimizer to maximize or minimize the output cell, rather than aim for a specific target value.

Because they automate the what-if process, backsolvers and optimizers are enormous labor-savers. With time and patience, you could solve the problems they solve yourself, just by plugging in values and testing their effects. But life's too short, particularly for the complex resource-allocation problems that are the special province of optimizers.

BEST CASE, WORST CASE

One traditional form of problem analysis that's ripe for automation is scenario modeling. When the future holds many uncertainties, not just one or two, it's handy to lay out alternative combinations of uncertain values side by side or sheet by sheet, so you can see the range of possible outcomes at a glance. So far, the program that assists most with this process is Micro-soft Excel 4.0.

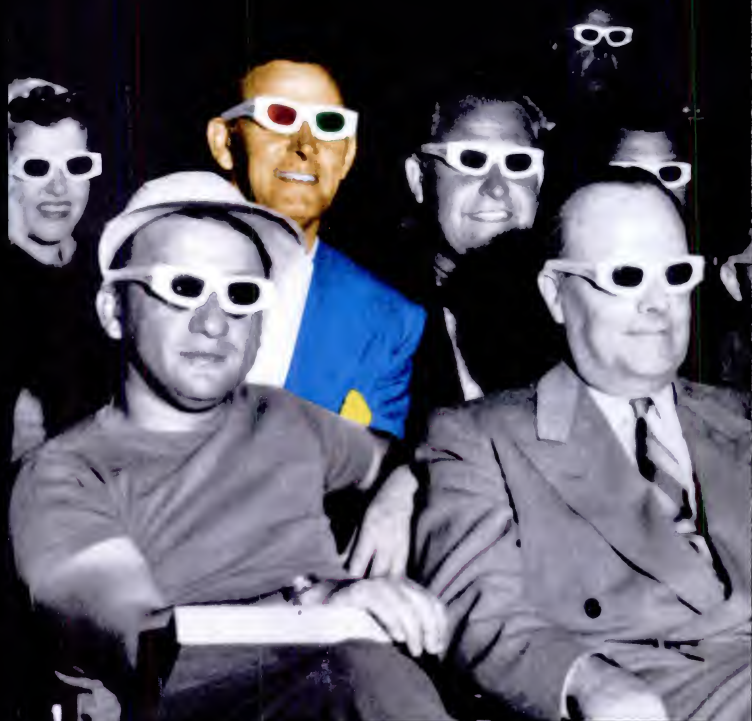
The Scenario Manager add-in,

introduced in Excel's latest update, lets you designate the uncertain cells in a model, then assign combinations of values to each uncertain cell. Each combination of values becomes a named scenario (you choose the names, of course). Then you tell the add-in which outputs you're interested in, and it builds a table showing the impact of each named scenario on each designated output cell.

NEWCOMERS

Borland International's contribution to scenario management is thus far limited to a Model Copy option, included in Quattro Pro for Windows. Model Copy simplifies the task of reproducing a framework of formulas on multiple pages of a QPW notebook. Normally when you copy formulas from one page to another, relative references are updated and absolute references are left unchanged. With Model Copy, the absolute references to cells on the current page are updated on the target pages. For example, if you model-copy the formula \$BestCase:A1 from the page named BestCase to the page named WorstCase, the formula becomes \$WorstCase:A1 at its new location. By itself the Model Copy command is by no means a full-fledged scenario-management system, because it provides no mechanism for summarizing and comparing scenarios. But it's a step in the right direction.

Lotus Development Corp. is rumored to be working on a scenario-management feature for its next release of Lotus 1-2-3 for Windows. Given the similarity of features between 1-2-3 for Windows and 1-2-3, Release 3.1, it's reasonable to expect that this technology will find a way into Lotus's advanced DOS product as well. □



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4. Close the page and slip-sheet

3. Slice the folded edge

2. Arrow pointing to the fold

1. Front side touching the free page

2. Insert this sheet with

1. Open the foldout page

Inverted Foldout slip-sheet



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Foldout slip-sheet

Folded edge of the page

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



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Back

1. Follow instructions on the other side



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mulas, exactly as you would use range names. A formula summing cell A1 at pages that are named East, North, South, and West, for example, might read @SUM(East..West:A1). (Excel's workbook feature offers drag-and-drop rearrangement and a comparable form of structural overview, but its cross-sheet referencing syntax is more complicated.) Names can also be assigned to designated groups of pages.

OBJECT OF DISCUSSION

Beyond the notebook metaphor, QPW's most distinctive characteristic is its object orientation. Just about everything you see and touch in QPW is an object that has properties. You don't format anything in QPW; rather, you inspect and modify properties. Right-click on any object—a cell, a range, a page tab, the document title bar, the application title bar, a graph series, a graph legend, a graph axis, and so on—and QPW displays an "Object Inspector Menu." This is a dialog box listing all the properties of the current object. Select a property name here (Number Format, for example, if the current object is a cell or range), and Inspector presents all available settings.

In other words, there are no formatting commands on QPW's menus. Formatting and other properties are all handled through interactions with dialog boxes that pop up when you right-click

on the object. Right-click on the application title bar and you can set global options. Right-click on the document title bar and you can apply recalculation settings. Right-click on a page tab to modify a page's properties, or select a range and format it. There are some disadvantages to QPW's object orientation, since it's not always obvious which attribute is a property of which object. Is a secondary y-axis a property of a graph? (No, it's a property of the data series that's plotted against it. Why isn't the series instead a

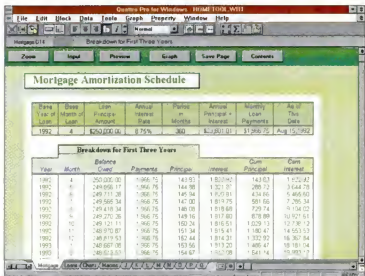
property of the axis?) Moreover, the approach can seem inconsistent. Page names, for example, are assigned via the page property inspector. But range names and graph-title text are applied by means of traditional menu commands and are not properties of anything.

To the developer, object orientation should prove to be an unequivocal benefit. An @PROPERTY function (somewhat like @CELL but an order of magnitude more versatile) and four property-oriented macro verbs provide a straightforward syntax (simpler than that of the corresponding Excel functions) for controlling and responding to the environment.

In addition, QPW comes with a swank "UI Builder" that lets developers create dialog boxes and icon palettes simply by pointing to controls on a SpeedBar, dropping the controls into the dialog or palette, sizing and positioning the controls, and then assigning properties. None of this requires a single line of code. Linking UI objects to procedural code is similarly a matter of selecting property options. The linking paradigm is "ON event DO verb TO/FROM object," and the events, verbs, and objects (both direct and indirect) are all available from context-appropriate lists.

In terms of analytic prowess, QPW remains several paces behind Excel and even a step or two behind its own DOS counterpart. QPW went into develop-

ment well ahead of Quattro Pro 4.0 and came out the other end without Quattro Pro 4.0's analytic graphing features and auditor. (The nonlinear optimizer made it into the Windows product, however, along with named styles and user-defined display formats.) Meanwhile, neither Borland product can match the depth and breadth of Excel's function library, and neither offers outlining, a cross-tab generator, name-based consolidation, or Excel's ability to name cells based on their row and column names.



Quattro Pro for Windows has prodigious presentation power, but the heading in D14 had to be centered by hand over columns D through G.

GORGEOUS GRAPHICS

On the graphing, presentation, and data-management fronts QPW shines. QPW's graphs are gorgeous, easy to generate, easy to embed on the worksheet, and easy to edit (once you learn the property taxonomy). Rotatable 3-D chart types are included, and bitmaps can be applied not only to plot markers but also to chart backgrounds. The program includes an extensive set of drawing tools for annotating graphs. All drawing must be done in an independent graph window, whose contents may then be embedded anywhere within the worksheet.

QPW includes an interactive print previewer. Margins, headers, and footers can be adjusted there via the mouse, but column boundaries cannot (Excel lets you adjust both). A handy color button toggles between color and monochrome output. Other printing conveniences include the ability to gang a nonconvenient selection onto a single output page

PC FACT FILE

Quattro Pro for Windows, Version 1.0

Borland International Inc., 1800 Green Hills Rd., P.O. Box 660001, Scotts Valley, CA 95067; 800-331-0877, 408-461-9122

List price: \$495.

Requires: 2MB RAM (3MB recommended), 10MB hard disk space, DOS 3.3 or later, Windows 3.0 or later.

In short: A strong first entry into the Windows spreadsheet market, Quattro Pro for Windows features a three-dimensional worksheet structure, beautiful graphics, easy access to dBASE and Paradox data, and a wealth of original usability features. The program lacks some of Microsoft Excel's advanced analytic capabilities, but its notebook metaphor makes multipage worksheets more functional than ever before.

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COVER STORY

Spreadsheets

(something that requires a clumsy work-around in Excel) and a toggle that lets you choose between printing a range of worksheet pages on separate output pages or collecting them into a single report. Page scaling and print-to-fit are also available, but QPW (unlike Excel) does not offer automatic scaling to fit multiple pages.

QPW's slide show, like that of its DOS predecessor, has numerous visual transition options. In Windows, you also get a light table for reorganizing the show.

The internal database functionality is standard spreadsheet fare, but for query-

*Beyond the notebook
metaphor, Quattro
Pro for Windows'
most distinctive
characteristic is
its object
orientation.*

ing external dBASE and Paradox files, QPW comes with a separate database desktop application—a beautifully designed query-by-example tool based on the forthcoming Paradox for Windows. Like Quattro Pro 4.0, QPW also lets you read and write dBASE and Paradox files directly.

The program also imports and exports files in all of Lotus's formats, including both Allways and Wysiwyg formatting details. Here, however, our tests revealed one serious defect. 1-2-3 files (either .WK1 or .WK3) with associated .FMT or .FM3 files became obese on import into QPW, in some cases growing to ten times their original size. Borland says it's working on the problem.

All in all, QPW is a spreadsheet that demands our attention. Can it convert Excel and 1-2-3 users? That remains to be seen, but this is a strong product that proves that all the good ideas haven't been used up yet. □

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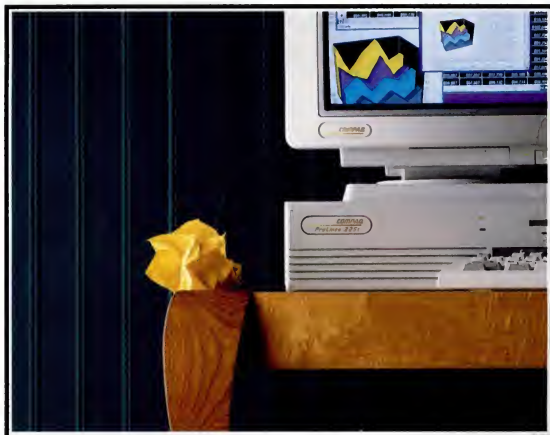
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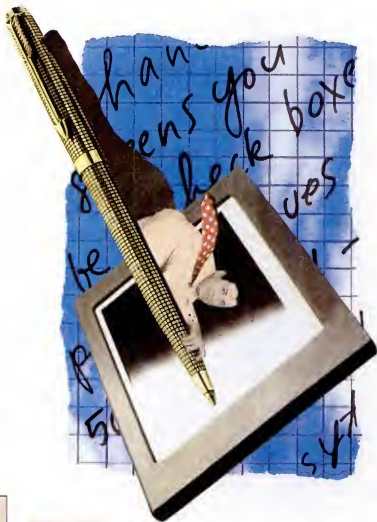
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Pen PCs

Are pentop, handheld, clipboard, and tablet PCs the next wave of portable computing? PC Labs examines the technology and the first eight systems. Our findings: They have a great future, but don't sell your notebook computer just yet.



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Pen computing is finally here. After one of the most hyped introductions since multimedia, the first pen systems that use either GO Corp.'s PenPoint or Microsoft Windows for Pen Computing have arrived. If you are to believe the hype, pen computing is supposed to bring computers to those of us who are afraid to touch a keyboard. Pen zealots say pen computing will make computing ubiquitous; you'll be able to take notes, send faxes, and remember your kids' birthdays.

by Christopher Barr

In this article, *PC Magazine* overviews the hardware and software technology behind pen computing and examines early pen-based portable systems.

WHERE'S THE BEEF?

Reality has already set in, and the promise of pen computing—as suggested in Momenta Corp.'s ad showing an executive lying on the floor, writing on his Momenta pen computer—just hasn't happened. And from what we've recently heard, Momenta isn't going to happen either. It has sold very few pen systems (sources say less than 1,000), and its future prospects are uncertain.

So why isn't pen computing taking over the world? This is because the hardware, operating systems, and software all are immature. There does not seem to be one "killer app" to lure users to the pen platform the way VisiCalc propelled the

Apple II or Lotus 1-2-3 sold IBM PCs. Pen applications currently under development from Slate Corp. and others may change that, but the real test will be whether large numbers of people will be compelled to buy a special computer to run them. It is also possible that pen computing will thrive not on broad horizontal applications (such as word processors and spreadsheets) but on hundreds of vertical applications such as tracking a parcel from point to point or handling on-site auto insurance claims.

Is the pen simply a better mouse? It can certainly be used as a mouse, but you issue commands to your pen computer by gesturing—pressing the pointer on the screen and flicking it a number of ways. For the first time, pen computing makes handwriting recognition possible for general business applications. Pens let you enter data without requiring a keyboard,

which means pen computers can have a smaller form factor than even notebook computers. We also believe pen techniques may supplant the mouse on the desktop for some users by the mid-1990s.

Pen computing and pen computers are for real, but they're not what you expected. What you want is a hand-held computer that runs today's applications and translates your scribbles into machine-readable text. Instead, these systems look and act a lot like the notebook computer you already carry, but they have pens and you can write on the screens. Handwriting recognition will play only a small part, since you will mainly use these screens for "writing" to check boxes.

The reality is that the first pen systems will be used for data collection, filling out forms, or vertical applications. These systems are perfect for evaluating the platform to see where it fits your business, and for developing pen applications.

Suitability to Task:

Pen-Based Computing

Evaluating a pen computer without its operating system is not a good idea. While some of our Suitability to Task ratings could measure a pen computer's actual capabilities, most required us to consider the pen computer together with its operating environment in order to rate its features properly. We therefore shifted the focus of our story so it was no longer strictly a pen-computer evaluation, but a more generalized look at pen computing.

We tested each pen computer under Microsoft Windows for Pen Computing, GO Corp.'s PenPoint, or both, factoring in such qualities as how well it navigates through the operating system, its responsiveness, and its usage of system utilities. However, we rated only the machines that were shipping at the time we tested them. We therefore have ratings for WriteAway! for the Zeos Notebook 386+, the GRiD-PAD SL, the IBM ThinkPad, the Momenta, the NCR 3125, and the NEC UltraLite SL/20P; we could not rate the Dauphin 5000 Series Pentop or the Z-Notepad.

General use includes file management, note-taking

SUITABILITY TO TASK

Product Name

	POOR	FAIR	GOOD	EXCELLENT
General use	●	○	○	○
Field/mobile use	●	●	○	○
Handwriting recognition	●	●	●	○
Communications	●	●	●	●
Notebook replacement	●	●	●	●

(without the handwriting recognition engine), forms completion, and everyday pen use.

Field/mobile use evaluates such factors as the rated battery life, travel weight and dimensions, operating temperature range, and ruggedized design.

Handwriting recognition covers vendor-specified and reviewer-tested features as well as subjective accuracy tests.

Communications rated such factors as file transfer to and from a desktop, along with modem, cellular, and radio communications.

Notebook replacement mainly deals with hardware features such as a keyboard, mouse, or pen; hard disk; floppy disk drive; video; ports; and memory.

PEN SYSTEMS: FOUR TYPES

Pen-based systems are broken down into four types: hand-held, clipboard, tablet, and pentop.

- Hand-held pen computers, like Fujitsu's PoqetPad, are shaped like a long steno pad; weigh 1 to 2 pounds; use DOS, a proprietary operating system, or both; are not powered by a 386 processor. They are used primarily for data collection. Future hand-held PCs from Apple Computer, EO Computer, General Magic, and Tandy Corp. will fit the form factor but will focus on PIM (personal information manager) software and communications. Sharp Electronics Corp. and Sony Corp. have already shipped pen-based hand-held PIM systems in Japan and both are selling well.

- Clipboard computers, like GRiD's original pen system, the GRiDPAD, are larger versions of hand-held PCs but are still underpowered because they don't use a 386. PI-Systems Corp. recently shipped a clipboard that uses a Motorola processor running a proprietary operating system.

- Tablet and pentop computers, which we will concentrate on here, run GO Corp.'s PenPoint, Microsoft Windows for Pen Computing, or Communication Intelligence Corp.'s PenDOS; weigh 4 to 8 pounds; are 386-based; and cost from



• Too clunky, too limited, too early

\$2,600 and \$5,000. The difference between tablets and pentops is that pentops have a keyboard in addition to a pen, and the keyboard is a link to current applications. In this issue we will look at tablets from GRiD Systems Corp., IBM Corp., and NCR Corp.; pentops from Dauphin Technology, Momena Corp., and NEC Technologies; and a hybrid system that pairs the Zeos Notebook 386+ with Arthur Dent Associates' WriteAway! digitizer.

The first usable pen systems will have features you can find on notebooks: 60MB hard disks, 4MB of RAM, internal floppy disk drives, modem slots and PCMCIA sockets, DOS, and Microsoft Windows. What separates them from notebooks is that they all use a pen and a digitized LCD panel.

DIGITIZER TECHNOLOGIES

There are primarily two types of digitizer technologies used by these PCs: *resistive* and *electromagnetic* (EM). Resistive digitizers, used on the WriteAway!, Dauphin, Momena, and NEC products, are overlaid onto the LCD's surface. The electromagnetic digitizers on the GRiD, IBM, NCR, and Zenith units are embedded beneath the LCD.

There are two types of EM digitizers: those that use an active pen with a passive grid, and vice versa. Wacom is in the first camp, and its digitizer works by radiating a signal from under the screen. A coil in the pen sends the pen's position back to the source. CalComp's EM digitizer has an active grid and a passive pen. It sends a magnetic signal from the pen to the grid, which acts like an antenna.

Resistive technology, used by Scriptel Corp. and MicroTouch Systems, has the pen make direct contact with the LCD's surface; a conductive coating of indium-tin oxide on the surface sends standard *x* and *y* coordinates by determining the voltage that is being emitted by the screen.

EM digitizers have a number of advantages over resistive digitizers. Some resistive units lower the light transmitted

The pentop and tablet products you can buy this year are good development tools to help prepare your company for pen computing when more robust products appear in 1993.

Right now, every aspect of pen computing has

weaknesses: The hardware and operating systems are nascent, there is almost no applications software, and handwriting recognition hasn't gotten beyond the recognition of noncursive writing. 1993 will also bring pen systems based on the Intel 486SL CPU, which is roughly twice as powerful as the 386SL. The extra horsepower can only help these systems.

If you are buying a tablet or pen system for pilot application development and you haven't committed to an operating system, you probably should get one that works with both PenPoint and Microsoft Windows for

Pen Computing, the two leading contenders. Not all do. If the system will be exclusively for development, a tablet is fine. Otherwise, look for a pen-top system with an integrated keyboard, which makes your pen computer a notebook computer.

Among the systems PC Magazine Labs overviewed, we believe you will find the Dauphin 5000 Series Pentop, GridPAD SL, IBM ThinkPad, and NCR 3125 worth your consideration as development tablets, along with the NEC UltraLite SL/20P and Z-Note-pad hybrid pentop systems with built-in keyboards.

by the LCD because there is an extra coating of wires on the screen to block the light. EM digitizers are cordless, and they can produce a third axis, the *z*-axis, which can be used to show depth or pressure. But resistive digitizers tend to cost less than EM digitizers and weigh a bit less.

OPERATING SYSTEMS

While we concentrated on pen systems that run 386-based PenPoint, Pen Windows, or both, most of the pen systems available today can run a number of operating systems, including 32-bit PenDOS, GRiD's PenRight!, and ordinary DOS. Handwriting engines are embedded into the operating systems of pen-specific operating systems, giving them an advantage over ordinary DOS.

GeoWorks announced it will make Pen/GEOS for low-cost hand-held com-

puters due later this year from Tandy Corp. Pen/GEOS will use a handwriting recognition engine licensed from Palm Computing. Apple is developing the Newton for its Newton and is using a proprietary handwriting engine.

HAND PRINTING RECOGNITION

One thing all pen operating systems share is handwriting recognition. Pen Windows uses the Microsoft Alphanumeric Recognition System, PenDOS uses its Handwriter Recognition System, and PenPoint uses its own engine. But different handwriting engines can be used by each operating system. It's up to each vendor to decide. Some engines are better for filling out forms, and others are best suited for Roman characters.

Handwriting recognition is a misnomer. It's really hand printing recognition. Even the best engines today can't recognize cursive text, and they have a really hard time with the connected characters (ligatures) most people write even when printing. To combat writing inconsistencies, you can train most handwriting rec-

Our Contributors: CHRISTOPHER BARR is a senior editor of *PC Magazine*. BRUCE BROWN is a contributing editor of *PC Magazine*. ALAN M. STOUTON is a former project leader of PC Magazine Labs and is currently a computer consultant in New Jersey.

ognition engines to learn your handwriting, and in the process you will learn what the engine will (or more likely will not) recognize. You can save your session so that other users can have their own handwriting dictionaries.

PEN-CENTRIC VS. PEN-AWARE

Two new terms describing applications are *pen-centric* and *pen-aware*; ISVs (independent software vendors) will debate the relative merits of both to differentiate their products. Pen-aware applications have been modified to recognize pen input and gestures. Microsoft Word for Windows, Version 2.0, is an example of a pen-aware application. A pen-centric application, on the other hand, was built for a pen interface and assumes there is no keyboard. Slate Corp.'s AtHand spreadsheet is pen-centric.

INK AS A DATA TYPE

Pen computing introduces a new way to get at and store data: *inking*. "Ink" is a new data type that may appear bitmapped but is really vector-based. Ink saves chronological pen-specific stroke information such as the pen's starting and ending points, direction, velocity, and pressure, and color of the ink. This vector information, which is a series of x and y coordinates, can be scaled, is device independent, and lets the application judge which information to use.

Programs that require handwriting recognition need to know stroke order to differentiate, for instance, between a 5 and an S, or a 6 and a b. Stroke order tells the recognition software that a 5 has two strokes and the S only one, and a 6 is written from the top down in one stroke, while a b has two strokes. Future signature-verification programs will demand a stroke order, along with velocity and pressure information, in order to authenticate a signature.

Not every application will need that much information and may simply rasterize the ink to a bitmap, keeping the file size as small as possible. Like other graphics files, ink is stored in a compressed format.

Slate's Day-Timer Pen Scheduler, with PenPoint and Pen Windows versions, uses electronic ink strictly for note-taking and handwriting recognition only for names and addresses. Instead of

PEN COMPUTING can bring PCs to millions of people who don't use keyboard-based units. But before pens take off, the hardware, operating systems, software, and handwriting recognition must improve considerably.

A PEN COMPUTER is either a lightweight *hand-held* or slightly larger *clipboard* PC with modest CPU power, a more powerful *tablet* PC lacking an integrated keyboard (most have a keyboard jack), or a *pentop* PC with an integrated keyboard.

ADOLESCENT might be the best description of the first pen-based hardware platforms. We tested eight pentop and tablet products from Arthur Dent, Dauphin, GRiD, IBM, Momenta, NCR, NEC, and Zenith. These 1992 pen products are more like development and familiarization tools—the forerunners of more robust systems that will be coming out over the next year.

OPERATING SYSTEMS are offered by a half-dozen vendors. The two major

spending CPU time and power to translate scribbles into ASCII, it stores them as ink. Day-Timer Pen Scheduler assumes you are the only one who will read it anyway, so there is no need to spend system resources.

Pensoft's Perspective, for PenPoint only, uses ink in different ways, depending upon your need. Its InkWell feature captures notes that can be saved as ink, or recognized as text at a later, more convenient time. Or you can save your doodles as a drawing with no recognition.

REVIEW CRITERIA

To be included in this technology-overview article, we required vendors to have available shipping or solid-prototype portable pen systems as of midsummer. The systems could be pen-only (tablets), hybrids with keyboards (pentops), or notebooks with add-on stylus-sensitive screen overlay panels.

HIGHLIGHTS

Pen-Based PCs

contenders are Microsoft Windows for Pen Computing and GO Corp.'s PenPoint. Pen Windows was available on seven of the eight systems tested; PenPoint came with five.

HANDWRITING RECOGNITION, better called *hand printing recognition*, works passably on block-printed characters. True cursive handwriting recognition still requires a quantum leap in technology.

DESKTOP PC USERS may eventually replace their mice with tablets and pens. The first desktop tablets have big limitations—most notably the restriction to VGA.

APPLICATIONS SOFTWARE is written for the operating system, not the computer. The first pen-specific apps will be schedulers and personal information managers. Pen Windows has the advantage that Microsoft Windows software, which is pen-aware, already works; in addition, pen-centric software takes advantage of pen computers.

Normally, *PC Magazine* accepts only shipping products for review. We made exceptions here because we believe that even the shipping systems are still somewhat adolescent, and you will get a better feel for the market by reading about eight products in various states of readiness than reading about half as many shipping systems.

NOW WE TESTED

PC Magazine Labs evaluated the eight systems for fit and finish, for general ruggedness, and for screen readability in a range of lighting conditions. We also gave the shipping systems Suitability to Task ratings in five areas—general use, field and mobile use, handwriting recognition, communications tasks, and notebook replacement—and report them with the reviews. Comments in our overviews and reviews are based on the judgments from the Suitability to Task script.

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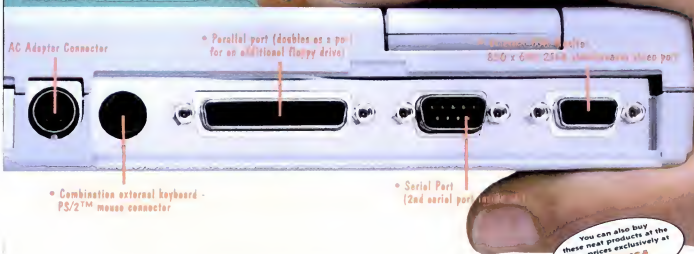
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CIRCLE 357 ON READER SERVICE CARD

■ Pen Techniques on the Desktop

For some users, pen-based digitizer tablets could replace mice.

Pen computing isn't limited to portable computers. Desktop PCs can share this technology, too. Software developers can use desktop PCs with pen modifications to design and test pen-based applications. For end users, it is possible that for some applications pens and pads may eventually replace mice. The ability to lasso a block of text or spreadsheet data with the pen and then move it by drawing an arrow may be more "intuitive" than clicking with a mouse.

PC Labs took an informal look at three very different in-the-office pen systems:

- Mouse System Corp.'s \$349 PenMate, an opaque digitizer tablet;
- CalComp's \$2,195 DisplayPad, a digitizer tablet with an embedded flat-panel LCD panel; and
- Smart Technologies' Smart 2000 Presentation System, a \$9,875 to \$17,130 touch-sensitive electronic whiteboard with options for projecting screen images onto the board and for video conferencing.

All three products show the promise of desktop pen computing, even with their current shortcomings. The two desktop pads, for instance, don't work at any resolution except vanilla VGA.

PEN WINDOWS

Microsoft Windows for Pen Computing (a variant of Microsoft Windows 3.1) unlocks the pen-aware features built into some applications and makes others pen-compatible. By using Pen Windows' PenPalette, the user can have the PC recognize and insert hand-printed text at the cursor point. The tested products used Windows 3.1 with Pen Windows. PenPoint is not a factor on the desktop, where DOS/Windows compatibility is required.

MOUSE SYSTEMS' PENMATE

Mouse System Corp.'s PenMate is a 9.5-by-13.3-inch digitizer-only device (no video output) that connects to the COM1 or COM2 port. PenMate's software installs Pen Windows and the utility programs used to orient and configure PenMate. Its power supply connects in piggyback fashion to a specially designed DB-25 connector, and the pen stylus plugs into a PS/2-type connector on the writing pad's top left.



Smart Technologies' Smart 2000 Presentation System

As you move the tip of the corded pen over the pad's 6- by 9-inch pen-sensitive area, the screen cursor tracks its motion. Using the pen while watching the monitor felt a bit awkward, but you may be able to get used to it. Press lightly on the pen to actuate a switch in the tip (you'll hear a "mouse click."). You must activate this switch while drawing or printing text; it is a technique that is akin to pressing hard when making a carbon copy. Pressing a secondary button on the pen barrel simulates two-button mouse operation.

PenMate's software reserves the bottom area of the pad for 14 programmable buttons. An overlay is imprinted with default settings such as Enter, Switch App,

Close App, Minimize, and PageUp. As a mouse replacement, the PenMate will take some getting used to, but for basic pen applications it's a low-cost introduction.

CALCOMP'S DISPLAYPAD

CalComp's DisplayPad features an LCD flat-panel VGA display overlaid with a high-resolution digitizer in 13.3- by 10.5-inch desktop package. One of its strongest features is its cordless pen, which felt

like a quality writing instrument and had an excellent pen-on-paper feel when used on the tablet's slight-friction surface.

The pen uses a patented Advanced Function Technology (AFT) design and can run for 300 hours on hearing-aid-type batteries, according to CalComp. The pen uses an electromagnetic radiation principle, and the pen-tablet interface allows for the sensing of tip pressure, tilt angle, and height. These features make this pad best suited to special graphics and security applications.

The DisplayPad's combination display and interface card replaces the computer's video adapter and simultaneously drives the tablet's CCFT (cold-cathode fluorescent tube) sidelit 0.30-dot-pitch display and a standard 640-by-480 monitor. The clear LCD panel offers a 64-shade gray scale, and the display card and drivers will support 256 simultaneous colors on the monitor. Another mode allows 16-color 800-by-600 resolution on a Super VGA monitor, but the pad's display becomes inactive. The interface card can use COM1 through COM4 for input and connects to the display with a single cable.

We had to edit system files manually to install the DisplayPad, but CalComp said future versions will have automatic installation software. CalComp's drivers allow you to fine tune or toggle features

such as the pen-sampling rate, cursor redraw times, pen-pressure sensitivity, and pen-barrel buttons. The DisplayPad can also operate under PenPoint and Communication Intelligence Corp.'s PenDOS operating systems.

At \$2,195 (an extra pen costs another \$200), the DisplayPad is only for the serious pen-application developer or vertical-application user, for whom the time savings justifies the investment.

SMART 2000 PRESENTATION SYSTEM

Smart Technologies' Smart 2000 Presentation System, a touch-sensitive whiteboard measuring 3 by 4 feet, looks like a standard whiteboard you use with felt-tip markers, but you can use the markers to touch a projected image to make Windows selections, or use a finger or a pen to draw, annotate, or enter text recognized by Windows for Pen Computing.

The PC video output connects to a color LCD projection panel, such as the color In Focus PC Viewer Model 5000FX sent with the Smart 2000, which is then placed on an overhead projector. The Smart 100 Host Adapter Card mounts in any 8-bit or 16-bit slot and connects to the Smart whiteboard via a single 25-pin conductor cable. Installation of the Smart software is straightforward.

As you write on it with your finger, the projected image creates the illusion that ink is flowing directly onto the

board. Since the image is projected, you have to work from the side. You can choose colors with a Windows tool bar or by lifting colored markers from a pen tray beneath the board. As you lift a marker, a switch changes the software to the selected color.

The Smart 2000 Presentation System is designed for single locations, while its

Conferencing System connects up to 20 different locations via modem. With the conferencing configuration, annotations and changes made during a conference call will appear at all connected sites. You can use a second conference hook-up for voice and bring both sight

and sound to a conference.

A conferencing system, including a 386/40 PC with an 80MB hard disk, ATI VGA Wonder card, In Focus PC Viewer Model 5000FX, high-intensity overhead projector, and multipoint modem, costs \$17,130. A conferencing system without the PC, viewer, and projector is \$9,875.

—Alan M.

Stoughton



CalComp's \$2,195 DisplayPad



Mouse System Corp.'s \$349 PenMate

Scottsdale, AZ 85260; 602-948-6540

Mouse Systems Corp., 47505 Seabridge Dr., Fremont, CA 94538; 510-656-1117

Smart Technologies Inc., #599, 240-11 Avenue S.W., Calgary, Alberta, Canada T2R 0C3; 403-233-9333

ON THE HORIZON

Because the market is so new and the products so youthful, we are not awarding any an Editors' Choice distinction. None of the shipping systems are advanced enough to be suited for widespread adoption within a company. We think these products as a whole are clearly pilot or prototype systems that can be used to develop, test, and experience pen computing. While these current systems are fine for evaluating the pen environment, we expect smaller pen computers to be released within the next year from the same vendors and others. Next year's models will be made expressly for pen computing; in other words, they won't be simply hardware add-ons.

Among the best that we've seen is a system that NEC previewed at the PC Expo trade show in New York City this past June. The 4-pound prototype had a built-in hard disk, a PCMCIA 2.0 socket,

None of the shipping systems are advanced enough to be suited for widespread adoption within a company.

used a cordless pen, and supported both Pen Windows and PenPoint. It will be available later this year. Other companies with systems in the works include GRiD, MicroSlate, Sanyo, Samsung, TelePad, Toshiba, and Tusk.

In the future, pen computers will use Intel's new 3.3-volt 486SL at speeds up to 25 or 33 MHz. They will use application-specific silicon to do the handwriting recognition that relieves the CPU from double duty. They'll have sound chips, too. Wireless networking may finally be possible with technology under development by Ardis, Ericsson GE Mobile Communications, and Photonics Corp. For an overview of the technology driving the portable market—tiny hard disks, PCMCIA cards, wireless communications, and 3.3-volt and low-power components—see "Downsizing Notebook PCs: The Incredible Shrinking Subnotebook," *PC Magazine*, October 27, 1992.

Pen and Tablet PCs

Arthur Dent Associates Inc.

WriteAway! for the
Zeos Notebook 386+

ALL REVIEWS

BY BRUCE BROWN

An add-on is a good way to try pen computing at a minimal expense. If you already own a 386SX/20 Zeos Notebook 386+, you can convert it to a pen system by adding Arthur Dent Associates' \$595



WriteAway! for the Zeos Notebook 386+, \$595

WriteAway! for the Zeos Notebook 386+. You will probably find that WriteAway! is a bit clumsy for much more than experimental use, however. (Arthur Dent says improvements are already in the works.)

WriteAway! consists of three hardware components: an 11-ounce glass and plastic laminate digitizer overlay (a thinner, 8-oz version will be shipping by the time you read this), a controller card that plugs into the internal modem slot, and a tethered pen with a pen holder that installs on the side of the computer. The tether and the short wire loop that runs from the modem slot to the screen's lower-left corner might be easy to snag as you're carrying the PC.

With WriteAway! installed, the Zeos Notebook 386+ weighs 7 pounds, or 9.5 with an AC adapter and extra battery.

To install the WriteAway, you position the overlay over the notebook's screen and press along its adhesive-backed edges. The company recommends first cleaning the screen with a glass cleaner. Unfortunately, the acetone-based cleaner we used left a residue that weakened the adhesive and caused the overlay to slip out of place; closing the top broke some of the circuitry screened onto its perimeter. However, Arthur

Dent is testing adhesives that will hold better and still allow deinstallation.

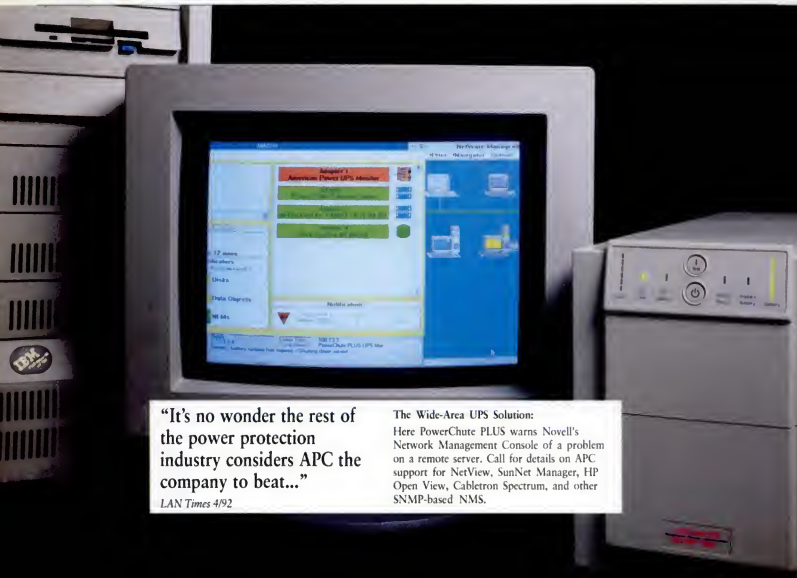
Microsoft Windows for Pen Computing runs adequately on the Zeos with the WriteAway! installed. The WriteAway!-equipped Zeos scored competitively with the other shipping products on our handwriting recognition tests.

The WriteAway! was sold with the

SUITABILITY TO TASK

WriteAway! for the Zeos Notebook 386+ (under Pen Windows)

	POOR	FAIR	GOOD	EXCELLENT
General use	●	●	○	○
Field/mobile use	●	○	○	○
Handwriting recognition	●	●	○	○
Communications	●	○	○	○
Notebook replacement	●	●	●	○



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LAN Times 4/92

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COMPUTERS

Pen and Tablet PCs

FACT FILE

WriteAway! for the Zeos Notebook 386+

Arthur Dent Associates Inc., 500 Clark Rd.,
Tewksbury, MA 01876; 508-858-3742;
fax, 508-858-3745

List price (tested configuration): \$595.

Tested configuration: WriteAway! digitizer; Zeos Notebook 386+; 4MB RAM; 60MB hard disk; DOS 5.0; Microsoft Windows 3.1; Microsoft Windows for Pen Computing, Version 1.0.

Requires: Zeos Notebook 386+, DOS 3.1 or later, Microsoft Windows 3.1.

In short: This add-on digitizer screen overlay lets you try pen computing at a low cost, but right now it only works with the Zeos Notebook 386+ (and soon the Compaq LTE Lite series of notebooks). Though WriteAway! still has some limitations, improvements are coming.

 ON READER SERVICE CARD

Zeos Notebook 386+ (now discontinued) and Windows for \$2,495. However, a similar WriteAway! panel is being prepared for the Compaq LTE Lite series.

Dauphin Technology Inc.

Dauphin 5000 Series Pentop

Dauphin Technology plans to ship the Dauphin 5000 Series Pentop in November of 1992. This attractive \$2,995 system uses a 512-dot-per-inch Scriptel resistive digitizer with a tethered stylus and will support a variety of major pen operating systems.

The Pentop is a full-featured notebook whose dual BIOS can support both DOS-based and pen applications.

PC Magazine Labs tested a beta unit with Microsoft Windows for Pen Computing installed. The Dauphin Pentop weighs 5.5 pounds with its internal nickel cadmium battery pack and measures 1.8 by 11 by 9.6 inches. The battery life is rated at 3 hours; with power management features engaged, this time can be extended by about 25 percent. Extra batteries weigh about 0.75 pounds each. With a not-yet-released 0.4-pound AC adapter, the system's carrying weight

with one extra battery and charger will be less than 7 pounds.

Based on a 25-MHz Intel 386SL, the Dauphin Pentop comes with 4MB of RAM, a 64K cache, a 40MB hard disk, and an internal 1.44MB floppy disk drive. RAM is expandable to 20MB, and hard

*The reasonably priced
Dauphin 5000 Series*

*Pentop lets you
experiment without
much risk; it's a fine
machine for desktop use.*

disks will be available in 80MB, 130MB, and 200MB sizes. The backlit VGA screen measures 9.5 inches diagonally; it can display 64 shades of gray and allows simultaneous display with an external monitor. A front hinge lets it lie flat or

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Smart-UPS 900 (pictured)	CAD/CAM stations, servers	\$899
Smart-UPS 1250	multiple servers, telecom	\$1199
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APC
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Pen and Tablet PCs

flip forward for desktop use. Because the Dauphin's hard disk and floppy disk drive are built-in and it has a backlit screen, you need to add only an external keyboard for conventional, non-pen computing. The unit will ship with the external keyboard included in the price.

I/O interfaces include one parallel and one serial port, a simultaneous external VGA port, a 100-pin AT bus connector for an optional \$195 single-slot expansion chassis, and a PS/2 port that you can use for either an external keyboard or a mouse. Options will include an external 1.2MB floppy disk drive, a PCMCIA 1.0 slot in place of the internal floppy disk drive, a math coprocessor, an AC adapter, an internal 14.4K data/fax modem, extra batteries, and a carrying case.



The Dauphin 5000 Series Pentop, \$2,995

The Dauphin Pentop supports Pen Windows, Communication Intelligence Corp.'s PenDOS, and GO Corp.'s Pen-Point. Its Phoenix ROM BIOS allows dual booting, so you can have more than one operating system on the unit. For example, you might want to use DOS and Microsoft Windows 3.1 with an attached keyboard but switch to Pen-Point for a vertical application when you're out on the road. The Pentop's

handwriting recognition was somewhat disappointing, but remember that this was a preview unit.

Being a reasonably priced machine, the Dauphin 5000 Series Pentop allows you to experiment without taking much of a risk. With an external keyboard, it's a fine pen PC for desktop use. At the same time, the Pentop's multiple operat-

FACT FILE

Dauphin 5000 Series Pentop

Dauphin Technology Inc., 450 Eisenhower Ln. N., Lombard, IL 60148; 800-782-7922, 708-627-4004; fax, 708-627-7618

List price (tested configuration): \$2,995 (available fall 1992).

Tested configuration: 4MB RAM, 40MB Conner hard disk, 1.44MB internal floppy disk drive, DOS 5.0; Microsoft Windows 3.1; Microsoft Windows for Pen Computing, Version 1.0.

Options: External 5.25-inch floppy disk drive, \$259; 387SLC math coprocessor, \$75; one-slot expansion chassis, \$195; extra battery, \$59; battery charger, \$45; 14,400-bps data/fax modem, \$499; PCMCIA slot, \$79.

In short: The 386SL/25 Dauphin 5000 Series Pentop promises to be a competitive pentop system. It should perform well in the field and also in the office when you plug in a keyboard.



ON READER SERVICE CARD

ing systems, dual booting, and medium weight make it a good general-purpose pen-based system.



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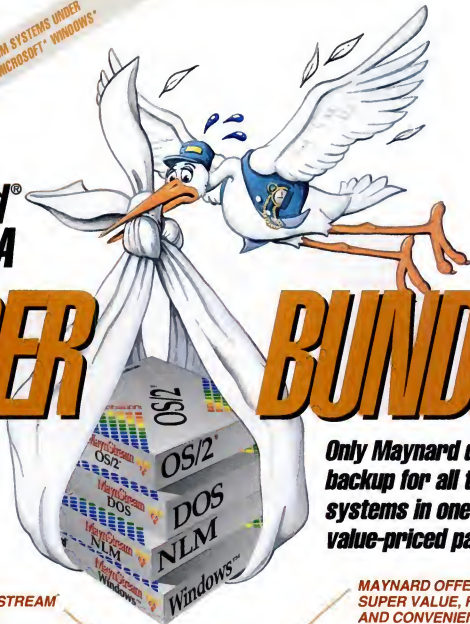
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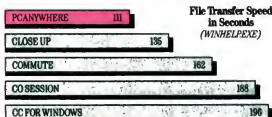
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GRiD Systems Corp.

GRiDPAD SL

The GRiDPAD SL is a very capable tablet-style pen device that has a built-in Wacom passive inductive digitizer with a cordless pen. A good choice for general-purpose pen applications, it doubles as a fine but somewhat expensive notebook.

The GRiDPAD SL lists for \$4,395 with 4MB of RAM (expandable to 20MB) and a 60MB hard disk. The modem handles 2,400-bps MNP 4 and MNP 5 data and 9,600-bps send/receive fax duties. Without a modem, the same configuration lists for \$3,995. These prices are high, but since GRiD Systems Corp. sells direct to corporate and institutional customers, you can probably find discounts.

The GRiDPAD SL measures 1.8 by 11.5 by 9.5 inches and weighs 5.5 pounds with its battery, an internal nickel cadmium battery pack that you can remove and recharge. With the charger, power cord, and carrying case, it comes to 7.7 pounds. Each extra battery costs \$99 and weighs 1.1 pounds.

The GRiDPAD SL is based on the Intel 386SL/20. Its 10-inch screen, a bright-blue backlit CCFT (cold-cathode fluorescent tube), uses high-contrast transmissive technology and displays 32 shades of gray in 640-by-480 resolution. Designed as a tablet, the GRiDPAD SL doesn't have an internal floppy disk drive or an integrated keyboard, although there are ports for adding external versions of both. I/O interfaces consist of one parallel, one serial, and one external VGA port, along with a PCMCIA 1.0 storage-card slot for SRAM or flash ROM cards. Rubber flaps cover all the ports, ensuring safe field use. The unit

SUITABILITY TO TASK**GRiDPAD SL
(under Pen Windows)**

	POOR	FAIR	GOOD	EXCELLENT
General use	●	●	●	○
Field/mobile use	●	●	○	○
Handwriting recognition	●	●	●	○
Communications	●	○	○	○
Notebook replacement	●	●	●	○

comes with DOS 5.0 and a carrying case.

Options include a \$590 4MB RAM upgrade, two PCMCIA RAM storage cards (1MB costs \$275 and 2MB costs \$625), a \$250 external floppy disk drive, a \$169 math coprocessor, a \$119 car battery adapter, and extra pens (\$80 each).

The unit was designed to run all major software environments, including GO



The GRiDPAD SL, \$4,395

Corp.'s PenPoint, CIC's PenDOS, Microsoft Windows for Pen Computing, and GRiD's own PenRight! We tested the GRiDPAD SL with PenPoint and Pen Windows. It fared well on our handwriting recognition tests under both: Its total character recognition score was 91 percent under Pen Windows and 90 percent under PenPoint. Its total word recognition was 72 percent under Pen Windows and 66 percent under PenPoint.

The GRiDPAD SL makes full use of the 386SL's built-in power management and adds power-conservation modes accessible through a setup program. It supports Microsoft's Advanced Power Management system and the Phoenix PMS power management system. Unfortunately, the backlit LCD and other components take their toll on system power, shortening battery life to about 2 hours. It takes 1.5 to 2 hours to charge a battery

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SUITABILITY TO TASK**GRiDPAD SL
(under PenPoint)**

	POOR	FAIR	GOOD	EXCELLENT
General use	●	●	●	○
Field/mobile use	●	●	○	○
Handwriting recognition	●	●	○	○
Communications	●	●	○	○
Notebook replacement	●	●	●	○



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HP LaserJet III[®]

Okay, here's a hint. The market leading laser printer features HP[®] PCL5 printer control language. The MT908 laser printer from Mannesmann Tally is PCL5 compatible, as well. Oops. The market leader provides 8 scalable fonts. The MT908 gives you the same scalable fonts. Hmm. The market leader offers a feature for smoother edges on fonts and graphics. The MT908 has Edge Enhanced Technology (EET[®]) for the same effect.

Alright. What about performance? The market leader prints at 8 pages per minute and includes the processing power of the Motorola 68000. The MT908 prints at 8 pages per minute but provides 2.5 times faster processing of scaled fonts and graphics with its Intel i80960 RISC pro-

cessor. Now we're getting somewhere.

The market leader comes with a 250 sheet capacity letter-size cassette. If you want to load legal paper, envelopes etc., you'll have to buy additional cassettes. For more convenient paper handling, the universal paper cassette of the MT908 adjusts to hold 250 sheets of letter, legal and international sizes or up to 30 envelopes. And, there is an optional 300 sheet second paper bin that mounts under the MT908... you can't even buy that from the market leader.

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Pen and Tablet PCs

FACT FILE

GRIDPAD SL

GRiD Systems Corp., 47211 Lakeview Blvd., Fremont, CA 94537; 800-654-4743; 510-656-4700; fax, 510-683-9888

List price (tested configuration): \$4,395.

Tested configuration: 4MB RAM; 60MB hard disk; PCMCIA 1.0 storage-card slot; modem (2,400-bps MNP 4 and MNP 5 data, 9,600 send/receive fax); DDS 5.0; Microsoft Windows for Pen Computing, Version 1.0, PenPoint; carrying case.

Options: 4MB RAM upgrade, \$590; external floppy disk drive, \$250; 80387SX math coprocessor, \$169; 1MB PCMCIA RAM storage card, \$275; 2MB PCMCIA RAM storage card, \$525; extra battery, \$99; quick charger, \$115; AC power adapter, \$125; car battery adapter, \$119; extra stylus, \$80.

In short: The 20-MHz GRIDPAD SL tablet supports all major pen operating environments. A little bigger and heavier than the NCR 3125, the GRIDPAD SL is a very good general-purpose pen system.



ON READER SERVICE CARD

fully with the power off and 12 hours with the power on.

Size, weight, and short battery life restrict the GRiDPAD SL to occasional field or mobile use. Still, GRiD's past experience with pen-based systems shows in this very competent tablet unit. And for introduction this November, GRiD is readying a hybrid laptop/tablet whose top swivels to reveal a keyboard.

IBM Corp.

IBM ThinkPad

The 386SX/20-based IBM ThinkPad was available only by special order at the time of this review but is slated for release during the fourth quarter of 1992. This pleasant-to-use tablet-style pen device has an electromagnetic digitizer and a cordless pen. However, GO Corp.'s PenPoint is the only pen operating system it can use.

Because the unit is not yet released, IBM hasn't set list prices for the ThinkPad or its accessories. Two basic configurations are available, one with 4MB of RAM and the other with 8MB. List prices are estimated at \$5,000.

The ThinkPad's 10-inch transreflective screen is bright and easy to see under most conditions. A slight surface etching

helps makes you feel like you're writing on paper.

Instead of a conventional hard disk, the ThinkPad uses the IDE Series solid-state mass storage system made by SunDisk Corp. Smaller than most floppy disk

drives, SunDisk's solid-state mass storage system consists of two easily removable 10MB memory cards. Almost indestructible, they are about the size of a credit card and about a quarter of an inch thick. Other standard features include Pen-

Point, a modem for 2,400-bps MNP 5 and 9,600-bps send/receive fax, and a carrying case with an ingenious weight-distributing neck strap. The unit has one parallel, one serial port, a SCSI port for an external floppy disk drive, one PS/2-style keyboard connector, but no monitor port. There is no internal floppy disk drive or

built-in keyboard, either standard or optional. The only peripherals are 1.44MB and 2.88MB floppy disk drives and an external keyboard. Accessories include a quick charger, extra batteries, and pens.

If you're going to carry the ThinkPad

around much, you will want the case and neck strap. The tablet measures 1.6 by 12.4 by 9.4 inches and weighs 6.3 pounds with a battery. Extra batteries are 1.1 pounds each. The AC adapter/battery charger is built-in and included in the 6.3-

pound weight.

Battery life is rated up to 3 hours. Recharging with the internal charger takes about 3.5 hours with the power off and 16 hours with the power on. The optional external charger can fully charge two depleted batteries in 6 hours.

The ThinkPad is rugged (it can resist

SUITABILITY TO TASK

IBM ThinkPad
(under PenPoint)

	POOR	FAIR	GOOD	EXCELLENT
General use	●	●	●	●
Field/mobile use	●	●	●	●
Handwriting recognition	●	●	●	●
Communications	●	●	●	●
Notebook replacement	●	●	●	●

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Pen and Tablet PCs

moisture and withstand temperatures up to 35 degrees Centigrade at 95 percent humidity). The carrying case's shock absorption should enable the unit to survive a 24-inch drop onto a steel plate and a 48-inch drop onto concrete.

Handwriting recognition is a strong point. On our tests the ThinkPad tied with the Momena for first place, with 92



The IBM ThinkPad, \$5,400 (estimated)

percent on the total character recognition test; its total-word recognition score of 69 percent was among the top scores.

The ThinkPad's size and weight will make it tough to carry around all day, even with the surprisingly effective case strap. Its superior screen and fast cartridges do make it a strong candidate for general pen use, especially for handwriting recognition and forms completion.

FACT FILE

IBM ThinkPad

IBM Corp., 1133 Westchester Ave., White Plains, NY 10604; 800-772-2227, 404-238-2200 (for Pen Assist Developer's Program)

List price (tested configuration): Special-bid machines only at this time. Estimated price is \$4,800 with 4MB RAM and \$5,400 with 8MB RAM.

Tested configuration: 8MB RAM, two 10MB IBM solid-state files, modem (2,400-bps MNP 5 data, 9,600-bps fax), PenPoint, carrying case.

Options (no prices available): External 1.44MB floppy disk drive, external 2.88MB floppy disk drive, rechargeable battery pack, battery charger, extra stylus.

In Short: This 386SX/20's transreflective screen is easy to read, and writing on its etched screen feels more natural than on slippery glass. But since it runs only GO Corp.'s PenPoint, it must await a broader suite of user applications.



ON READER SERVICE CARD

Momena Corp.

Momena

Momena Corp.'s namesake product, a tablet-style unit with a proprietary 300-dot-per-inch digitizer and a tethered pen, was the best performer on our handwriting-recognition tests. We tested it with Microsoft Windows for Pen Computing.

Based on a 386SX/20, our \$3,895 test system came with 8MB of RAM, an 80MB hard disk, a modem capable of 2,400-bps MNP 4 and MNP 5 V.42 and 9,600-bps send/receive fax duties, an external keyboard, DOS 5.0, Pen Windows, Rupp's FXLink, The Norton Backup, Hayes' Smartcom EZ, and a carrying case. All this hardware and software is standard. The only lower-priced Momena model is a 4MB RAM version that lists for \$3,595.

The unit's 10-inch nonbacklit reflective LCD screen is legible but hard to read in areas that are not well-lit. The screen, which runs at 640-by-480, is hinged to the case in the front; you can tilt it upright for desktop use.

I/O consists of a parallel port that can accept an optional 1.44MB floppy disk drive (\$299), a 9-pin serial port, and a port for the proprietary low-power keyboard. There is no external video port.

The Momena's wedge-shaped case slopes from 2.3 inches in the back to 1.2 inches in the front; its footprint is 11.5 by 10 inches. The system weighs 6.5 pounds with a battery; a separate AC adapter/battery charger weighs 1.3 pounds. The traveling weight for the tablet with a battery, AC adapter, and case is 9.6 pounds—light enough to transport but too much to carry around.

Momena Corp. rates the tablet's battery life at roughly 2 hours. Recharging takes 1 hour with the power off and 2 hours with the power on. A spare battery weighs 0.6 pounds and costs \$49.95.

On our handwriting recognition tests, the Momena was 92 percent accurate at

FACT FILE

Momena

Momena Corp., 295 No. Bernardo Ave., Mountain View, CA 94043; 800-666-3682; fax, 415-969-3877

List price (tested configuration): \$3,895.

Tested configuration: 8MB RAM; 80MB hard disk, DOS 5.0; Microsoft Windows 3.1; Microsoft Windows for Pen Computing, Version 1.0; FXLink; The Norton Backup; Smartcom EZ; external keyboard; modem (2,400-bps MNP 4 and MNP 5 V.42, 9,600-bps fax); carrying case.

Options: External 1.44MB floppy disk drive, \$299; external keyboard, \$149; extra battery, \$49.95; battery charger, \$149; replacement stylus, \$24.95; two stylus tips, \$4.99.

In short: Because of its high weight and low battery life, the tablet-style 386SX/20 Momena is better suited for desktop than mobile use. It does support both Windows for Pens and PenPoint and scored exceptionally well on the handwriting recognition tests.



ON READER SERVICE CARD

total character recognition (it tied the IBM ThinkPad for first) and 72 percent accurate on our total word recognition

test (this time it tied for first with the GRIDPAD SL running Pen Windows).

The Momena's top scores on handwriting recognition suggest forms completion and data collection as its best uses. Regrettably, the company's financial situation makes product distribution iffy: As of this writing, Momena was uncertain if it would keep marketing its tablet system.

SUITABILITY TO TASK

Momena
(under Pen Windows)

	POOR	FAIR	GOOD	EXCELLENT
General use	●	●	●	○
Field/mobile use	●	●	○	○
Handwriting recognition	●	●	●	○
Communications	●	●	○	○
Notebook replacement	●	●	●	○



The Momena, \$3,895

The screenshot shows the ABC FlowCharter software interface. The title bar reads "ABC FlowCharter - [D:\ABC2\AUDIT AF2]". The menu bar includes "File", "Edit", "Window", and "Help". The "PROCESS" toolbar contains icons for adding, deleting, and connecting shapes, along with a numeric keypad. The main workspace displays a flowchart for "ABC2 AUDIT AF2". The flowchart starts with a "START" shape, followed by "Makeover dates", "Check out notes", and "E book". A decision diamond follows, leading to "Folio check" and "Program reviewed (check folio & book)". From "Program reviewed", the flow splits into "Check report" and "Check report". The "Check report" shapes lead to "New account" and "New volume". A "FINISH" shape is also present. On the right, the "ABC Shapes Palette" is open, showing various flowchart symbols. At the bottom, a status bar indicates "Click and drag down into chart to add a new guideline." and a toolbar with navigation icons.

NCR Corp.

NCR 3125

Using a Wacom digitizer and a cordless pen, the NCR 3125 was one of the first DOS-based pen systems. Recently NCR Corp. repriced it at \$3,487 with 8MB of RAM and a 20MB hard disk—about \$2,000 less. However, this PC is about to be overshadowed by a better version.

Before this issue appears, NCR plans to introduce a new model, the NCR 3130.

SUITABILITY TO TASK**NCR 3125
(under Pen Windows)**

	POOR	FAIR	GOOD	EXCELLENT
General use	●	●	●	○
Field/mobile use	●	●	●	○
Handwriting recognition	●	●	○	○
Communications	●	●	○	○
Notebook replacement	●	●	●	○

which has a backlit screen and a 40MB hard disk. It will sell at the current price of the NCR 3125, and the latter model will be priced slightly lower. PC Magazine Labs had a last-minute chance to examine a late beta version of the NCR 3130 but not enough time to test it.

The NCR 3130's battery is a bit heavier than that used in the NCR 3125 to maintain battery life near the 4-hour level. Its monochrome passive-matrix backlit screen also adds a bit of weight. The new unit has a 40MB hard disk that is quieter than the 20MB unit in the NCR 3125. Together these changes increase the NCR 3130's weight to about 4.8 pounds—still admirable and much better than the competition. Operationally,



The NCR 3125, \$3,487

FACT FILE**NCR 3125**

NCR Corp., 1700 S. Patterson Blvd.,
Dayton, OH 45479; 800-225-5627,
513-445-5000

List price (tested configuration): \$3,487.

Tested configuration: 8MB RAM, 20MB hard disk, DOS 5.0; Microsoft Windows 3.1; Microsoft Windows for Pen Computing, Version 1.0; LapLink Pen with cable.

Options: 4MB RAM upgrade, \$394; 2MB FEPROM internal upgrade, \$404; 8MB FEPROM, \$1,151; external floppy disk drive, \$386; external keyboard, \$65; extra battery pack, \$58; car battery adapter, \$138; modem (2,400-bps MNP 5 data, 9,600-bps send/receive fax), \$357; leather carrying case, \$182.

In short: The 386SL/20 NCR 3125, with a 20MB hard disk, is only 4.5 pounds and has a good 4-hour battery life. It suffers from a dim screen, but a new model, the NCR 3130, will have a backlit screen and a 40MB hard disk (and should be available by the time you read this). The NCR 3125 is a versatile pen machine that is already considered a standard.



ON READER SERVICE CARD

both models appear to be identical.

The NCR 3125 augments the 386SL/20's power saving with its own modes, resulting in a 4-hour battery life. It measures 1.1 by 11.7 by 9.4 inches with the battery attached across the back and weighs 4.5 pounds. With the AC adapter, cable, and carrying case, the traveling weight is 7.7 pounds.

If you don't want a hard disk, you can order the NCR 3125 with a PCMCIA slot that accepts an 8MB flash RAM card. This PC has no conventional ports: A 1.4-inch-wide standard I/O strip plugs into the unit's right side and has one parallel and one serial port, an external VGA port, and a PS/2 keyboard connector. A slot on the left side can hold either an internal modem or a floppy disk controller card.

The NCR 3125 supports Pen Windows, Communication Intelligence Corp.'s PenDOS, GO Corp.'s PenPoint, and GRID's PenRight! We tested two NCR 3125 units, one with Microsoft Win-

dows for Pen Computing and one with PenPoint. Both its scores on our handwriting recognition tests were low: 84 percent for total character recognition under Pen Windows and 85 percent under PenPoint; its total word recognition was 55 percent for both. But this PC received the highest ratings for field and mobile use due to its size, weight, and battery life.

A lower price and new model (the NCR 3130 with 40MB hard disk) make this the best deal of tablet-only systems.

NEC Technologies Inc.

NEC UltraLite SL/20P

The NEC UltraLite SL/20P is an aggressively priced convertible notebook/pen system. Powered by an Intel 386SL/20 with a 16K cache and at least 4MB of RAM, the SL/20P costs \$2,799 with an 80MB Quantum hard disk and \$3,199 with a 120MB unit.

Although it may best be used as an add-on to a DOS notebook if you want to experiment with pen computing, it also serves well as a dual-purpose machine.

The SL/20P incorporates a Micro-Touch resistive digitizer with a tethered stylus and comes standard with Microsoft Windows for Pen Computing. The 9.5-inch-diagonal backlit screen, clear and usable under all lighting conditions, is etched and has the desirable pen-on-paper feel. The display handles 640-by-480. Standard features include a 1.44MB

floppy disk drive, DOS 5.0, Microsoft Windows 3.1, Slate's Day-Timer Pen Scheduler, and NEC's UltraDraw pen note-jotter.

Not designed to be carried around all day, the SL/20P measures 2.2 by 11.5 by 9 inches and weighs 6.8 pounds

including a battery. With a 1.1-pound AC adapter and an extra 1-pound battery, it has an 8.9-pound traveling weight. The battery life is rated at 2.5 hours, and recharging takes 3 hours with the power off and 15 hours with the power on. Extra batteries cost \$129 each.

Options include RAM upgrades

SUITABILITY TO TASK**NCR 3125
(under PenPoint)**

	POOR	FAIR	GOOD	EXCELLENT
General use	●	●	○	○
Field/mobile use	●	●	●	○
Handwriting recognition	●	●	○	○
Communications	●	●	○	○
Notebook replacement	●	●	●	○

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SYMANTEC.

FACT FILE

NEC UltraLite SL/20P

NEC Technologies Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; 800-388-8888; 508-264-8000; fax, 800-366-0476

List price (tested configuration): \$3,199.

Tested configuration: 4MB RAM, 120MB hard disk, 1.44MB floppy disk drive; DOS 5.0; Microsoft Windows 3.1; Microsoft Windows for Pen Computing, Version 1.0; Day-Timer Pen Scheduler; UltraDraw.

Options: 2MB RAM upgrade, \$269; 4MB RAM upgrade, \$629; external 5.25-inch floppy disk drive, \$259; math coprocessor, \$579; numeric keypad, \$129; expansion chassis, \$899; extra battery, \$129; battery charger, \$299; car battery adapter, \$59; 9,600-bps data/fax modem, \$499; 14.4-Kbps data/fax modem, \$699; regular carrying case, \$89; deluxe carrying case, \$299; slip-cover, \$25.

In short: The NEC UltraLite SL/20P, a 20-MHz 386SL convertible notebook, uses a MicroTouch resistive digitizer screen and a tethered pen. A fine notebook computer, its suitability is fair to good for most pen computing tasks.

ON READER SERVICE CARD

(2MB for \$269 and 4MB for \$629), an external 5.25-inch floppy disk drive (\$259), a car battery adapter (\$59), and two data/fax modems (a \$499 9,600-bps unit and a \$699 14,400-bps unit). An expansion chassis (\$899) has one full-length and two half-length slots.

I/O interfaces include one parallel and one serial port, an AT bus port for the expansion chassis, and a PS/2 keyboard port connector. An external VGA port



The NEC UltraLite SL/20P, \$3,199

supports 16 simultaneous colors in 800-by-600 and 2 simultaneous colors in 1,024-by-768. The PC doesn't support simultaneous display.

The SL/20P performed moderately

well on handwriting recognition under Pen Windows. Total character recognition was 87 percent, and its total word recognition was 62 percent.

The UltraLite SL/20P is too heavy for all-day use in the field and doesn't have the greater ruggedness and environmental protection found in some other systems. For everyday office use, however, the SL/20P is a fine candidate.

Zenith Data Systems

Z-Notepad

Zenith Data Systems plans to release its Z-Notepad, a convertible pen system with an electromagnetic digitizer based on the 386SL/25 Z-Note notebook, during the first quarter of 1993. Pricing for

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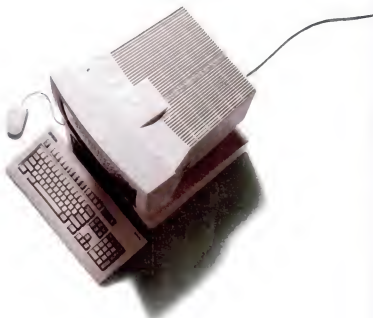
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The Z-Notepad, \$3,750 (estimated)

the new unit is not yet available, but you can expect to pay about \$500 more for a pen-aware system than for a comparably equipped Z-Note.

PC Magazine Labs worked with a beta version of the Z-Notepad, which had 4MB of RAM and an 80MB hard disk. The Z-Notepad will ship with a 120MB hard disk and either Microsoft Windows for Pen Computing or GO Corp.'s Pen-Point. Since a Z-Note with 4MB of RAM and a 120MB hard disk currently costs \$3,249, you can expect the list price for the Z-Notepad to be about \$3,750 unless prices for the other notebooks change.

FACT FILE

Z-Notepad

Zenith Data Systems, 2150 E. Lake Cook Rd., Buffalo Grove, IL 60089; 800-553-0331, 708-808-5000

List price (tested configuration): \$3,750 (estimated, available first quarter 1993).

Tested configuration: 4MB RAM; 80MB (will ship with 120MB hard disk) hard disk; 1.44MB internal floppy disk drive; DOS 5.0; Microsoft Windows 3.1; Microsoft Windows for Pen Computing, Version 1.0; Day-Timer Pen Scheduler.

Options: 2MB RAM upgrade, \$219; 8MB RAM upgrade, \$739; math coprocessor, \$329; numeric keypad, \$69; extra battery, \$159; battery charger, \$129; modem (2,400-bps MNP 5 V 42bis, 9,600-bps send/receive fax), \$369; modem (2,400-bps MNP 5 V 42bis suspend/resume-capable), \$259; port replicator, \$109; monitor stand, \$29.

In short: The Zenith Z-Notepad, which is due for availability in the first quarter of 1993, will add pen computing to the Z-Note notebook computer line. This convertible notebook system will use a CalComp digitizer, a cordless stylus, and the Z-Note's removable screen.



ON READER SERVICE CARD

Pen and Tablet PCs

The beta version of the Z-Notepad came in preproduction plastic. Its digitizer was different from the one that shipping units will use: a CalComp unit with a tethered, battery-operated pen.

The test unit measured 1.9 by 11.9 by 8.5 inches. The battery life, rated at 4 to 10 hours for the shipping Z-Notepad, takes advantage of the 386SL's power management and adds standby/resume and shutdown features of its own. If under normal conditions the actual battery performance exceeds 6 hours, the Z-Notepad will be a winner for mobile and field applications.

The Z-Notepad is expected to weigh 5.9 pounds with a battery. The AC adapter with the test machine, a standard Z-Note unit, weighs 3.5 pounds and raises

*If under normal conditions
the actual battery
performance exceeds 6
hours, the Z-Notepad will
be a winner for mobile and
field applications.*

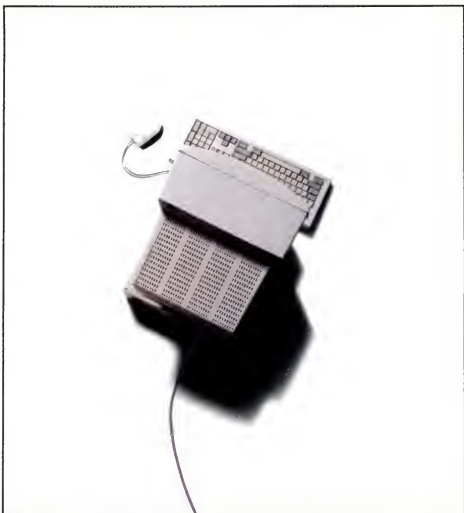
the unit's carrying weight considerably.

As with the Z-Note, the Z-Notepad's screen detaches from the system but stays connected by a cable so that you can hold it in your lap or put it on a table and run the system from the screen.

Since it's based on a notebook, the Z-Notepad will have a keyboard, an internal 1.44MB floppy disk drive, and the usual complement of ports. Options include RAM upgrades, a numeric keypad, extra batteries, two modems (including one with suspend/resume capability), a math coprocessor, a port replicator, and a monitor stand.

The Z-Notepad's handwriting-recognition accuracy and suitability-to-task ratings await the shipping product. It's safe to predict that the unit will score high as a notebook replacement, but other uses need testing.

At a price premium of about \$500 over the cost of a fine Z-Note, the Z-Notepad is a low-cost way to find out if pen computing makes sense for you.



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PENPOINT, PENDOS, WINDOWS FOR PEN

Pen Software

GRIID Corp. introduced the first pen computer in 1989, but pen computing didn't receive much attention until Microsoft and GO Corp. released their operating systems in the spring of 1992. Once Microsoft Windows for Pen Computing and GO Corp.'s PenPoint, appeared, horizontal and vertical software applications were quickly expected to follow. Yet with a few notable exceptions, such as Slate Corp.'s Day-Timer Pen Scheduler (available for both operating systems), most companies are citing delays or postponements.

Slower-than-expected growth in the pen hardware market, as well as uncertainty about which operating system will prevail, are said to be keeping software companies from committing fully to one operating system or the other. But these explanations don't tell the whole story.

Pen software is coming out slowly because software development is always harder than it looks at first.

Application software is written for operating systems, not for hardware. Several pen hardware vendors support more than one pen operating system.

Hardware from both NCR and GRiD can work with Communication Intelligence Corp.'s PenDOS, along with PenPoint and Pen Windows. GRiD's PenRight! is another newly offered alternative for the NCR 3125 and upcoming NCR 3130.

You'll also want to consider whether you can use pens with what you already have. Take a look at both pen-only sys-

tems as well as those with pen features added (pen-aware systems).

Most companies are choosing either GO Corp.'s PenPoint or Microsoft's Windows for Pen Computing as the two pen operating systems that will be most likely to last and have supporting application software.

PenPoint has a somewhat tougher fight for acceptance than does Pen Windows. PenPoint can use files from some DOS and Windows applications programs, but its file transfer and conversion is relatively awkward. PenPoint is at its best when it is running its own applications because it doesn't share files with other systems.

PenPoint is a document-oriented operating system that uses an image of a

ous application-program features to create, view, or edit the document components.

PenPoint is easier for new users to use, but it can be confusing to DOS and Windows veterans. You move through PenPoint and make selections via single pen taps on tabs, labels, and icons. The notebook interface is a standard with all PenPoint applications and includes collapsible and expandable outlining.

PenPoint can recognize handwriting and pen gestures for editing and other operations, but you can't teach the program new gestures, as you can with Pen Windows.

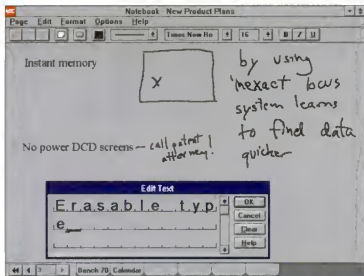
During the handwriting-recognition tests for this issue, for which each person used several different machines, we found that hardware was a greater performance differentiator than the operating system. The handwriting-recognition results do not indicate that either operating system excels over the other in this area.

We also found that two machines from different vendors, both running the same operating system, could have different scores (conversely, two same model PCs with different operating systems could have similar scores). However, there were exceptions to our finding that the hardware makes more of a difference than the operating system: When we tested the PenPoint and Pen Windows handwriting recognizers on the GRiD-PAD SL and NCR 3125 pen tablets, we found a greater similarity between the scores for the machines than for the operating system.

Another advantage of PenPoint is its deferred-communications ability. Both operating systems need to improve their communications abilities, but PenPoint is currently better in this area since it can tolerate a break in communication connections and allows simultaneous protocol connections.

Unfortunately, PenPoint doesn't have as many drivers as does Pen Windows, which limits its printing. The only current options are Epson, HP LaserJet, and some fax-printing drivers.

PenPoint calls for a bigger leap than Pen Windows because it is very different from established computing environments and because many companies are afraid to take a risk with a relative new-



Windows for Pen Computing applications use the familiar Windows interface. The screen above shows a page from the Microsoft Notebook application that combines a handwriting-recognition grid and raw screen ink as a data type.

notebook with tabbed dividers. In Windows or DOS applications, you select an application and then open a file, perhaps linked via OLE (Object Linking and Embedding) or DDE (Dynamic Data Exchange) to other applications. With PenPoint, you select a document, and without much foreground attention to which applications you're using, you move about the document by using vari-

Pen and Tablet PCs

comer. On the other hand, PenPoint's hardware and processor independence promises broad applications. AT&T and GO Corp. have recently announced that they're working together to use PenPoint with AT&T's new Hobbit RISC processor.

Since Windows is expected to be the dominant operating environment for the

since the files are already in their native operating system and application.

As with PenPoint, in Pen Windows you can bring up an on-screen graphical keyboard when you want to do data entry, word processing, or any other activity that would be tedious if you use handwriting recognition or impossible via icons and gestures.

Pen Windows and PenPoint aren't the only operating systems in town, though they get the most attention and are most likely to command the largest market share. Using its own set of gestures, PenDOS adds handwriting recognition and editing to DOS applications. PenDOS doesn't require the system resources needed for the other operating systems and can be called up to work with any DOS application.

GRiD's PenRight! is gaining attention because of applications that have already been developed for it. Applications-development tools and environments, along with programmers who know how to use them, already exist for PenRight! Companies that committed to earlier GRiD pen systems may now find that their applications run on a broader number of pen devices.

If you're not already committed to a particular pen operating system, this is a good time to start investigating the potentials of pen computing. Pen Windows is a safe bet for people who don't want to stray far from existing applications and hardware. As the safer bet, Pen Windows will likely have more supporting applications on the market sooner.

PenPoint, designed specifically for pen computing and for people who have never used computers before, is arguably easier to learn. You are also more likely to use PenPoint on more hardware formats, such as hand-held personal digital assistants (PDAs), than you would Pen Windows.

Pen computing is just starting to come of age. The next few years will likely see increasingly rapid developments in all four areas: hardware, operating systems, applications programs, and the actual installed user base.—Bruce Brown



Go's PenPoint memo editor lets you use handwriting recognition for creating memos and notes. PenPoint's interface has notebook tabs, function icons, and horizontal top line menus.

next few years, any product that works within it gets quick credibility. Pen Windows is not a substitute for Windows 3.1 but works with it; usually the vendor installs parts of Pen Windows in the hardware.

Pen Windows runs with Novell's NetWare; PenPoint does not. However, Pen Windows doesn't have PenPoint's multiple-communications protocol and deferred-communications feature. Pen Windows also lets you train it to recognize new editing gestures and handwriting samples, giving you more handwriting-recognition control than with PenPoint. Also, if you take the time to use the Windows for Pens trainer, handwriting-recognition scores will skyrocket.

Pen Windows also lets you use the pen to read files directly from other applications, which means you don't have to worry about file conversion or translation

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WINDOWS VS. OS/2

Will the New Standard Please Stand Up?

By Sheryl Canter

When Microsoft and IBM split and went their separate ways, PC users were presented with a confusing dilemma: Whom to bet on?

Which will become the new standard, Windows or OS/2? Should the choice be made strictly on technical merits, or should each company's marketing track record also be considered? After all, no one wants to be stuck backing a loser. The decision of which operating environment to adopt is an important one. Individuals and companies have a large investment of time and money in the choice—time for training and money for hardware and software.

Microsoft Windows 3.1 and OS/2 2.0 have been on the market for eight months. Their features and technical merits have been covered in depth in the press (for instance, *PC Magazine*, April 28, 1992). Now that some time has passed, we can evaluate what it's really like to "live in" each environment. The features may look good on paper, but what's the environment really like to use?

To answer this question, we asked each reviewer

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to make the system he reviewed his primary environment during the period of testing. In addition, we put each operating environment through extensive laboratory testing. We measured its speed in running applications of all types (DOS, Windows, and, where available, 32-bit OS/2) in each available mode. We also evaluated how well each system was suited for mainstream business applications, mission-critical applications, connectivity to other systems, and graphical applications, and its ease of use. Only by extensive testing of application software and peripherals can we paint a fair picture of what it's really like to live in these environments on a day-to-day basis.

THE TORCH MUST BE PASSED—BUT TO WHOM?

Why change operating environments at all? The answer is as simple as the question: because DOS isn't up to the task of supporting today's (and tomorrow's) sophisticated applications. DOS, which is ten years old, was developed to run on 16-bit 8088 machines running in *real*

mode. Real mode means that the memory addresses programs use internally are "real"—actual addresses—rather than stand-ins for other addresses. Because DOS operates only in real mode, it is *unprotected*; programs can overwrite

inches), but it offers little else. For virtually all other devices (printers, video, CD ROM), programmers are on their own.

The fact that DOS forces programmers to write to the hardware for so many basic tasks turns out to be the biggest obstacle to moving away from DOS. Because of the many thousands of DOS applications that PC users have come to rely on, it is not acceptable to replace DOS with an operating system that cannot run DOS applications. This may be the single most important reason why OS/2 1.x

did not succeed; it wasn't compatible with DOS applications. Yet because DOS applications take on so many functions that should be the responsibility of the operating system, ensuring compatibility is no easy task.

Windows and OS/2 offer two very different solutions to the limitations of DOS. Windows, which is actually a DOS application, "patches" DOS by providing an API for the features that the DOS API lacks. You can have Windows on your system and run DOS in a DOS box, or you can exit Windows entirely and return

areas of memory used by DOS and thus crash the system. DOS is also *single-tasking* rather than *multitasking*; only one program can execute at a time. The DOS user interface is unattractive and difficult to use because it is command-driven.

And the limits of DOS don't end here; what DOS lacks presents as many problems as what it offers. Its API (application programming interface) provides programmers with functions for device-independent file handling (for example, DOS doesn't care whether the floppy disk you're writing to is 3.5 or 5.25

Suitability to Task: Graphical Operating Environments

We rate a product's **connectivity and multitasking** abilities by measuring how well the operating environment communicates between programs and with other computers. Built-in awareness of other computer systems, reliable high-speed background communications, and interprocess communication features such as OLE (Object Linking and Embedding) and DDE (Dynamic Data Exchange) contribute to a high score in this area. Superior operating environments will have built-in terminal emulation and fully protected memory management.

For an operating environment to score well on **mainstream business applications**, high-quality software must be available to run the basic applications that businesses need: word processors, spreadsheets, low-end databases, presentation graphics packages, and communications software. Compatibility with popular applications, the availability of device drivers

SUITABILITY TO TASK	
Product Name	
	POOR FAIR GOOD EXCELLENT
Connectivity and multitasking	● ○ ○ ○
Mainstream business applications	● ● ● ○
Ease of use	● ● ● ○
Mission-critical applications	● ● ● ●
Graphical applications	● ● ● ●

for popular peripherals, and competitiveness with applications designed to run in other operating environments contribute to a high score in this area.

Ease of installation, configuration, and operation make for a high score in **ease of use**. The more automated the installation and configuration processes, the higher the score will be. The best user-interface designs will provide access to all the operat-

ing environment's features in a way that is easy to learn.

Mission-critical applications require a stable, crash-free environment, since they are the programs on which businesses depend. Such applications include accounting packages and high-end databases used to run businesses. Reliable multitasking with fully protected memory management that lets users shut down misbehaving applications without bringing down the entire system contributes to a high score.

A product's rating in **graphical applications** reflects how well the operating environment performs in running all types of graphically intensive applications: word processing software with graphical features, animation programs, CAD software, and desktop publishing software. Scalable fonts should be available, and screen displays should be integrated with printer output for true WYSIWYG functionality. Quick screen-refresh rates and support for advanced video boards also contribute to a high score.





to native DOS; you don't actually need to choose between the two.

OS/2, on the other hand, is an entirely new operating system that replaces DOS. You can use the cumbersome dual-boot option and keep both DOS and OS/2 on your computer, but IBM intends you to run OS/2 exclusively and use a DOS box to run your installed base of DOS applications. OS/2 can also run most Windows applications (except for the few that run only in 386 Enhanced mode), although the video resolution under Windows is currently limited to VGA, and OS/2 does not currently support Version 3.1 of Windows. Rebooting to load DOS is inconvenient, and you can experience unpleasant complications when running multiple operating systems on one computer.

DOES IT HAVE TO BE WINDOWS OR OS/2?

While Windows and OS/2 are the most visible solutions to the problems of DOS, they are not the only alternatives. The oldest alternative on the market is Unix, a 32-bit multitasking system that can support multiple processors and can run on multiple hardware platforms. Unlike DOS and OS/2, however, Unix isn't a specific product but a family of products. There are many versions of Unix marketed by as many vendors. There are also a number of different GUIs (graphical user interfaces) that can be used as front ends to Unix.

Unix, which was born in the seventies, has never quite made it out of universities and research centers except as a server operating system or as a vertical, turnkey system. Its hardware requirements are nothing out of the ordinary today but were way beyond the average grasp at the time of its introduction. The graphical front ends now available answer the last, key complaint about Unix—that it's terribly difficult to use. New Unix products such as Solaris from Sun Microsystems, UnixWare from Univel, and the port of NeXT Step to the Intel chip are impor-

• Microsoft Windows, Version 3.1

Our Editors' Choice is awarded to Microsoft Windows 3.1 for its ease of use, solid performance, and rich selection of high-quality applications in every software category. With Windows' Express Setup, you answer two simple questions and you're off.

The program's Custom Setup option, which allows more control over configuration, is almost as straightforward. Built-in network options, automatic detection and installation of most Windows and DOS applications, and the resounding support of hardware manufacturers make installation nearly foolproof.

Windows 3.1 delivers faster performance than OS/2 when used on systems with less than 12MB of RAM (which account for the majority of machines) and when running today's 16-bit applications. It performs well in mainstream business areas and with graphics applications, and it even does well with mission-critical tasks.

For now, Windows' biggest edge

over OS/2 is the overwhelming number and high quality of applications designed for it. You can run almost all Windows' programs under OS/2, but there are some limitations. Moreover, in doing so you do not take advantage of OS/2's unique capabilities.

There is no question that OS/2 has many technical advantages over Windows; its fully protected, preemptive, multithreaded design is certainly the direction of the future. Yet OS/2 2.0 still suffers from too many rough edges for us to recommend it. Installation on non-IBM hardware can be agonizing, quirks not yet worked out of the system can cause it to lock up unexpectedly, and IBM's technical support is uneven.

tant enough to warrant their own story. We will be covering Unix-based graphical operating environments in an upcoming issue of *PC Magazine*.

A more recent entrant into the graphical operating environment market is DESQview/X, from Quarterdeck Office Systems (see the sidebar "Multitasking with DESQview/X"). Like its text-based predecessor, DESQview, DESQview/X runs on top of DOS and provides multitasking and memory management features. The X version adds a GUI based on the Unix-world X Window library of primitives, which was recompiled by Quarterdeck to run under DOS. DESQ-

view/X can be run with one of three different window managers that use the X Window API: X-Motif, Open Look, or the proprietary DESQview/X window manager.

DESQview/X can run DOS or Windows applications, and X-Motif or Open Look applications from the Unix world can be easily ported. Windows applications execute very slowly under DESQview/X, but its DOS windows offer an appealing advantage: They are scalable to any size. DESQview/X also provides something completely different from either Windows or OS/2: distributed processing. If networked computers are running DESQview/X, applications can be run invisibly in the background on a remote computer.

THE WORLD AS VIEWED FROM WINDOWS

Windows offers a comprehensive API that includes calls for a standard user interface, multitasking, memory manage-

Our Contributors: SHERYL CANTER is the associate editor of the applications development team at *PC Magazine*. CHARLES PETZOLD, RICHARD HALE SHAW, and M. DAVID STONE are contributing editors to *PC Magazine*. LENNY BAILES is a freelance writer and the author of *Memory Management and Multitasking: Beyond 640K*, published by TAB/McGraw-Hill. PAUL BONNER is a senior editor of *PC/Computing* and the author of the *PC/Computing Guide to Customizing Windows 3.1*, published by Ziff-Davis Press.

ment, and device independence for programmers (see the sidebar "The Windows Programming Experience"). If there is a Windows driver for a device, you can read it or write to it, and Windows drivers are provided by just about every hardware manufacturer. So you no longer have to wonder if a particular application supports your printer. If the application runs under Windows and there is a Windows driver for your printer, the application will work with your printer.

The API calls for the user interface lets Windows programmers write applications that all work in the same way, greatly reducing the user's learning curve for new applications. Windows applications have a recognizable look and feel, and the same hotkeys will always work in the same way. Windows is delightfully easy to use.

Microsoft has taken care to ensure hardware compatibility and the availability of Windows applications by making early copies of the platform and API available to hardware manufacturers and developers before their release. The effort has paid off; drivers exist for virtually every type of peripheral (such as video boards and CD-ROM drives), and there are hundreds of high-quality Windows applications to choose from. By contrast, OS/2 hardware and software support lags behind.

Windows doesn't have it all, however. Since it is a DOS application, it is largely 16-bit and unprotected. From the user's perspective, this means it is relatively slow and has a tendency to crash. Its lack of *multithreading*—the ability to process multiple chains of commands at once—also contributes to its slowness and makes it *nonpreemptive* (or *cooperative*); the user must wait for one task to complete before starting another one. This means you must wait for one application to load before you can load another one, and you cannot do anything else after issuing a print command until your document has been spooled to the printer.

Virtually all of these problems will

supposedly be solved by Windows NT (NT stands for *new technology*), and NT will offer many other features such as support for 32-bit applications, multiple processors, networking, and data security (see the sidebar "Windows NT and Be-

OS/2 2.0 than directly under Windows itself, which is unprotected. And because OS/2 2.0 is multithreaded and preemptive, you don't have to wait for one task to complete before starting another.

OS/2's innovative GUI, the Work-



yond"). But NT will not be compatible with the majority of DOS and Windows applications on the market today (although the most popular applications will be supported), proving once again that moving forward while maintaining backward compatibility is extremely difficult.

OPERATING SYSTEM/2

OS/2 2.0 does not suffer from Windows' limitations; it is 32-bit, protected, multitasking, multithreaded, and preemptive. OS/2's ability to run 32-bit applications makes it potentially much faster than Windows, because bigger chunks of data can be moved around at one time. The rub, however, is that there are still almost no 32-bit OS/2 2.0 applications available. Since OS/2 1.x flopped and Windows 3.0 became such a smashing success, there has been trepidation among developers about the viability of OS/2 2.0 in the marketplace. Still, IBM says that more than 1,000 32-bit OS/2 2.0 applications will be available from third-party vendors by the end of the year. And in the meantime, OS/2 2.0 users can run both DOS and Windows applications under OS/2 in full-screen and windowed modes.

OS/2 2.0 is a fully protected operating system; multitasked applications cannot stomp on each other's memory space. Using the virtual addressing capabilities of the 80386 chip, when an application requests memory, OS/2 checks to see what's free and then assigns an unused memory address. Thus, Windows applications can be run more reliably under

place the user interface found in OS/2 1.x, programmers need not despair; the PM API is still used to write OS/2 2.0 programs (see the sidebar "The OS/2 Programming Experience").

But OS/2 isn't perfect, either. The lack of drivers for many popular peripheral devices can be a major frustration. Installation and setup require a high level of

patience and technical competence. Worse, OS/2's numerous quirks are bound to bite you if you try anything the least bit unexpected.

AND THE WINNER IS...

Although most pundits are betting on Windows because of its big edge over OS/2 in today's market, there is no winner yet in the operating environment war. Some 90 percent of PC users are still using DOS, and that is quite a swing vote. Meanwhile, Microsoft and IBM continue to work on bug fixes and upgrades as they do battle in the marketplace, and a new contender, Quarterdeck's DESQview/X, has appeared.

PC Magazine has conducted extensive performance testing and Suitability to Task evaluations of both operating environments. Does either provide a satisfactory enough alternative to DOS to warrant the cost of adoption? Consider your own needs and the experiences of our writers before answering this question. One thing's certain: Neither is a perfect solution. The reviews that follow should help you decide which environment is best suited to your requirements.

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► PERFORMANCE TESTS

Windows vs. OS/2

The best way to test an operating environment is to put it through controlled simulations of actual, day-to-day work, and this is what we attempt to do in the present suite of tests. Native applications are matched to each environment as closely as possible, and nonnative applications are tested as well.

HOW WE TESTED

To evaluate the performance of the graphical operating environments, PC Magazine Labs developed a comprehensive suite of application-based tests that provide relative performance measurements in real-world scenarios. While these tests reflect the combined performance of the operating environment and the applications used, they also illustrate the performance that a user would experience with different environment options. The current versions of popular applications were used to ensure the most direct comparisons possible.

We conducted all tests on a Compaq Deskpro 386/25M, an upgradable EISA machine, running a 25-MHz 386 processor with a 340MB IDE hard disk. We used standard VGA resolution and (except where otherwise stated) 8MB of system memory. For the printing tests, we used an HP LaserJet III with a PostScript cartridge. All of the results presented are the average of at least three consecutive passes, and the test machine was rebooted before each pass.

Each environment was configured in accordance with recommendations from the vendor. At IBM's request, we installed two performance upgrades to OS/2. The first was a kernel upgrade, which can be obtained in IBM's forum on CompuServe, and the second upgrade improved the performance of Win-OS/2, the portion of OS/2 responsible for running Windows. (Interestingly, the second upgrade improved the performance of both OS/2 and Windows applications.) This upgrade, although not available on CompuServe during testing, is available from IBM

technical support for customers who report problems with Win-OS/2 performance.

WORD PROCESSOR PERFORMANCE

To measure the relative performance of word processors native to each environment, we chose the Windows and OS/2 versions of two popular word processors: DeScribe Word Processor and Microsoft Word. While the OS/2 version of DeScribe is a 32-bit application written for OS/2 2.0, the latest version of Microsoft Word is a 16-bit application written for OS/2 1.x.

Program Load indicates the time each program takes to load, measured from the moment its icon is double-clicked to the point when the user regains control.

File Load measures the time taken to load a 400K text file with no graphics

or special formatting. In the case of Microsoft Word, the variation between Windows and OS/2 performance was negligible.

The scores for **Search and Replace** represent the time taken to replace 400 instances of the word *downturn* with the word *upturn*.

The **File Save** scores indicate how long each program takes to save the document with the changes.

The **File Print** scores represent the time taken to print a three-page file containing embedded .PCX, TIFF, and .WK1 images.

SPREADSHEET PERFORMANCE

To measure spreadsheet performance, we used the latest versions of Microsoft Excel: Version 4.0 (Windows) and Version 3.0 (OS/2). We also ran each test using 4MB, 8MB, and 16MB of system memory. The importance of avail-



WORD PROCESSOR PERFORMANCE

Seconds	Program Load	File Load	Search and Replace	File Save	File Print
DeScribe Word Processor (Windows)	16.5	19.6	11.0	12.1	65.0
Microsoft Word for Windows	7.7	1.5	4.9	2.1	57.4
DeScribe 32-Bit Word Processor (OS/2)	32.4	13.2	9.9	9.7	79.2
Microsoft Word for OS/2	10.9	2.0	5.7	4.2	89.9

Lower scores represent better performance.

SPREADSHEET PERFORMANCE

Seconds	Program Load	File Load	Math Recalc	Database Sort	Chart Print
Microsoft Excel 4.0 (Windows) (4MB)	7.9	16.2	26.1	5.1	104.8
Microsoft Excel 4.0 (Windows) (8MB)	7.2	16.4	25.8	4.7	101.2
Microsoft Excel 4.0 (Windows) (16MB)	7.0	16.3	25.6	4.7	102.4
Microsoft Excel 3.0 (OS/2) (4MB)	31.5	23.4	26.3	8.4	137.4
Microsoft Excel 3.0 (OS/2) (8MB)	11.2	19.4	26.1	6.4	90.0
Microsoft Excel 3.0 (OS/2) (16MB)	8.3	18.5	26.1	5.0	88.1

Lower scores represent better performance.

able memory to OS/2's performance is very evident in the results of this series of tests; some major degradations in speed with the 4MB configuration can be seen.

The **Program Load** scores indicate how long Excel takes to load up and return control to the tester.

In the **File Load** test, we load a 600K spreadsheet containing arithmetic functions and numerous text fields.

Math Recalc scores represent the time for a large number of arithmetic operations and functions to be calculated in the spreadsheet.

The results for **Database Sort** indicate the time each program takes to sort an area of 1,000 rows by 16 columns with a double-key sort. The primary key is a numeric field containing a SUM() function, and the secondary key is an alphabetical sort on text.

Chart Print measures each program's speed in printing a single page containing two different chart types and multiple-font text to a PostScript printer.

DOS APPLICATION PERFORMANCE

To measure how well a mainstream DOS business application would perform under each environment, PC Labs selected the best-selling word processor, WordPerfect 5.1 for DOS, and conducted the word processor tests (described above) under the various

DOS session types available in each environment.

For both Windows and OS/2, we ran WordPerfect alternately in windowed and full-screen sessions. We also tested DESQview/X running WordPerfect in windowed, full-screen, and scaled DOS sessions (see the sidebar "Multitasking with DESQview/X"). For comparison, we ran the word processor test suite under Compaq DOS 5.0, both with and without SmartDrive 4.0 loaded.

As expected, the full-screen sessions generally performed better than the respective windowed sessions. The performance under Windows was also consistently better than under OS/2.

MULTITASKING PERFORMANCE

Our **Multitasking** test measures the performance of Windows applications in a multitasking environment. This DDE-intensive test measures the time required to complete a predefined Excel macro in the background; the macro performs cut-and-paste operations, recalculations, and sorts while three other applications (Ami Pro 2.0, CorelDRAW 2.0, and Superbase 4) perform scripted operations simultaneously. We ran the Multitasking test

MULTITASKING PERFORMANCE

Seconds	
Microsoft Windows (4MB)	1,065
Microsoft Windows (8MB)	938
Microsoft Windows (16MB)	936
Win-OS/2 (4MB)	4,173
Win-OS/2 (8MB)	1,436
Win-OS/2 (16MB)	1,402
Seamless Win-OS/2 (4MB)	7,222
Seamless Win-OS/2 (8MB)	1,518
Seamless Win-OS/2 (16MB)	1,455
DESQview/X (4MB)	N/A
DESQview/X (8MB)	1,326
DESQview/X (16MB)	1,062

N/A—Not applicable: DESQview/X is unable to run our Multitasking test in a 4MB configuration.

Lower scores represent better performance.

for each environment in configurations with 4MB, 8MB, and 16MB of system memory.

We tested OS/2 with full-screen Win-OS/2 sessions as well as with "seamless" Win-OS/2 sessions from the desktop. In seamless mode, the Separate Session option was enabled (placing a separate copy of the Win-OS/2 kernel in memory for each session) to maintain maximum data integrity.

We also tested DESQview/X, using its ability to launch Standard-mode sessions of Windows 3.1 (already installed on the test machine) from within its native environment. DESQview/X is unable to run Windows and the applications used in our Multitasking test in a 4MB configuration.

Windows 3.1 was the clear winner on this test, exhibiting good performance in multitasking Windows applications even in the 4MB configuration. The performance of OS/2 was better in a full-screen Win-OS/2 session than in a seamless session, and once again the 4MB configuration presented OS/2 with a serious bottleneck. Presumably OS/2's performance will be better with native OS/2 2.0 applications optimized for a 32-bit flat memory module, as they become available.

DOS APPLICATION PERFORMANCE

Seconds	Program Load	File Load	Search and Replace	File Save	File Print
Compaq DOS	1.5	8.2	18.2	1.8	54.3
Compaq DOS with SmartDrive 4.0	1.3	4.8	17.3	1.9	54.2
Full-screen Windows	3.2	4.1	16.8	1.9	58.5
Windowed Windows	2.5	5.3	18.1	2.1	62.1
Full-screen OS/2	5.8	9.9	18.9	2.1	91.9
Windowed OS/2	5.6	10.2	21.6	2.3	92.9
Full-screen DESQview/X	3.0	2.9	19.3	2.3	94.0
Windowed DESQview/X	2.5	3.4	19.6	2.7	93.2
Scaled DESQview/X	2.9	4.8	19.2	2.4	93.7

Lower scores represent better performance

■ Multitasking with DESQview/X

by M. David Stone

In the battle for the disk drives and CPUs of multitasking PC users, Quarterdeck Office Systems' DESQview/X, Version 1.02, seems in danger of getting pushed to the side. Yet this environment is worth a look, if only because it brings something different to the party.

The original DESQview was a pioneer DOS multitasker. DESQview/X is a pioneer in bringing the X Window System along with distributed processing to DOS. The X Window System is a widely used graphical windowing standard in the multitasking Unix world.

The environment is based on servers and clients. The X Server is the control program in charge of the computer or workstation screen. X Clients are applications that hand off display information to the X Server. DESQview/X is simply an X Window system that sits on top of DOS.

An X Window system can run multiple windowed programs on a stand-alone system. But the magic of X Window lies in distributed processing on a network—the ability to load and control programs on another system and see the results on your screen. Any X Client on the network can talk to any X Server, even if one system is running DOS and the other is running Unix. That makes the program appealing for companies with Unix and DOS machines on the same network.

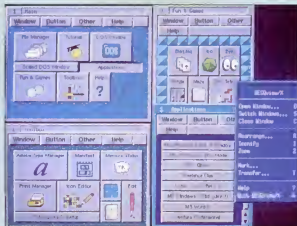
Tread carefully when the talk turns to servers: In standard network terminology, when you load a program from another system's disk drive, the remote machine is the server. In X Window, the machine you're *working at* runs the X Server program.

MENUS TO SUIT YOUR STYLE

DESQview/X is nothing if not flexible. The default menus are a graphical version of the text-based DESQview menus. The menus are designed for

both keyboard and mouse use. You can also redesign the menu structure, create additional menu levels, and move choices to different menus. And in case you prefer a more fully graphical approach, Quarterdeck supplies an Application Manager—an X Client that lets you create a completely separate set of icon-based menus.

At first glance the Application Manager menus seem very different from the default menus, but the differences are purely aesthetic. The Application Manager is a separate program



DESQview/X brings the X Window System along with distributed processing to DOS. Its multitasking graphical interface is highly customizable.

that needs about 650K of RAM, which reduces the amount available for other programs. You cannot use shortcut keys within the Application Manager. But you can add icons to the menu buttons, and you can pick up a button with the mouse to move it within the same window or place it in another menu window.

You have to enter choices for the two menu systems separately—once for each system. If you want to use both, or if you start with one menu system and then decide to switch, this is inconvenient. Quarterdeck says that a utility for converting between the two menu systems either will be included with the next release or will be available on request.

NOT A SPEED DEMON

Both PC Labs' tests and subjective experience indicate that using DESQview/X in full-screen mode is a little slower than running the same programs directly in DOS, but it's certainly acceptable. Performance is far slower for virtualized windows (scalable DOS boxes) but still tolerable on a 486/25 or better. DESQview/X also handles communications well, allowing a background CompuServe session with TrapCIS at 9,600 bps and V.42bis data compression.

Running Windows under DESQview/X slows things down considerably. In a full-screen window, Windows 3.1 runs at about the speed of Windows 3.0 running directly in DOS. In an X window (which you must use to take advantage of distributed processing), Windows slows down to a crawl, even on a 486/25.

Unlike Windows, DESQview/X will not let you switch between full-screen and virtualized DOS windows on the fly. You're stuck with whatever choice

you made in the program information file (PIF). If you want to use a program both ways, you have to create two PIFs for that program. One nifty feature is that you can install DOS programs to use scalable fonts that will change size on-screen when you change the size of the window. Unfortunately, the scalable fonts are slightly less readable than the standard fonts.

DESQview is notorious for needing its PIF settings just so. The same is true of DESQview/X, which is built on the same multitasking engine. To make the process easier, the program comes with settings for about 140 programs; with patience you can make it work with most DOS software. Quarterdeck provides free technical support for 90 days

after your first call, and several extended support plans are also available.

ON NETWORKS

If your office has networked DOS machines, you are likely to be interested in distributed processing. Not only will DESQview/X give you the potential for password-protected access to programs and files on other systems, it will let you easily share resources and even computing power.

If your office has networked Unix workstations, you'll probably be most impressed by the extension of distributed processing to include both DOS and Unix systems. DESQview/X also gives you the potential for a unified look and feel across all of the DOS and Unix workstations installed in your company.

Because the window manager is an X Window client, you can change the look and feel of an X Window system by running a different window manager. Quarterdeck licenses Sun Microsystems' version of Open Look, Open Windows (a \$200 option), and the Open Software Foundation's window manager OSF/Motif (\$250). Both are direct ports from Unix; the source code has a few minor changes, but both packages are essentially recompiled versions of the Unix files.

If you simply want a windowing system for a standalone machine, distributed processing is irrelevant. And even if you are concerned with distributed processing, you'll probably still run some programs on your own system. System requirements are substantial: a 386SX CPU with 4MB of RAM minimum and 6MB recommended. In truth, even a 386SX with 6MB will be severely underpowered for standalone work. A more reasonable minimum would be a 486SX with 8MB RAM. But on a network, distributed processing lets you take advantage of more powerful systems, using the 386SX system essentially as a terminal. Moreover, a 286 version of DESQview/X may be available by the time this review is published, which will allow you

to use a 286 system as a terminal to access more powerful computers.

NATIVE X WINDOW PROGRAMS

Quarterdeck says that virtually any Unix program that works under X Window can be easily ported to DOS so it will work under DESQview/X. In most cases, the application needs little more than recompiling. At this writing there are no native applications available except for the applets that come bundled with DESQview/X, but Quarterdeck says that DESQview/X versions of Interleaf's Interleaf and Z-Code's Z-Mail are undergoing beta

*If you have networked
Unix workstations,
you'll be impressed by
the extension of
distributed processing
to include both DOS
and Unix systems.*

testing, and that other software vendors have expressed interest in porting their programs.

You can get a taste of how graphical programs will look and feel under DESQview/X by working with the demonstration programs and applets that come with the package. The bundled applets include a file manager, a clock, a calendar, a graphical version of blackjack, and a DESQview/X version of Tetris.

Applications programmers should note that DESQview/X uses a superset of the DESQview API as well as X Protocol, the X Window API. Programs written to the DESQview API will work in either version of DESQview; to take advantage of X Window's graphics features, however, you'll need to write to X Window.

Like Windows, the X Window System consists mainly of a library of prim-

itives for performing tasks like drawing a box or changing the mouse cursor. In addition to this base library, there are Open Look and OSF/Motif libraries—not to be confused with the window managers of the same names—each of which provides higher-level building blocks such as window borders with the appropriate look and feel for the corresponding window manager. Most programs are written to these higher-level libraries, which, in turn, call on the base library.

Quarterdeck plans to have programmers' toolkits available by the time this review is published. These will include full documentation for the expanded DESQview API, guides for porting X Window programs from other platforms, and the appropriate MIT library files—recompiled for DOS—both for ported programs and for writing X Window programs directly. Quarterdeck will also be selling toolkits with Open Look and OSF/Motif libraries, also recompiled for DOS.

DESQview/X will be of most interest in offices with both DOS and Unix workstations where users would like to take advantage of distributed processing or have a standard interface on all systems. If you have lots of memory and a fast CPU, you may even find it attractive on a standalone system, particularly if X Window applications in DESQview/X become a reality.

► FACT FILE

DESQview/X, Version 1.02

Quarterdeck Office Systems, 150 Pico Blvd., Santa Monica, CA 90405; 310-392-9851; fax, 310-314-4217

List price: \$275 (\$100 until the end of 1992).

Requires: 386SX-based PC or better, 4MB RAM (6MB recommended), 40MB hard disk space, EGA display or better, DOS 3.x or later.

In short: DESQview/X brings the X Window System to DOS, and with it, distributed processing, which lets a low-end system borrow power and programs from better systems on the network. For standalone systems, you'll need a fast CPU and plenty of RAM.



ON READER SERVICE CARD

Windows 3.1: Popular and Compelling

Windows 3.1 handily
overcomes its DOS origins
with a world of applications.

By Paul Bonner



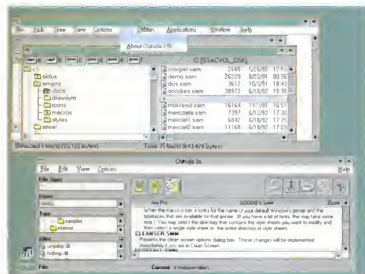
Microsoft Windows is no newcomer. Even if you dismiss earlier versions and consider the release of Version 3.0 in May 1990 as Windows' debut, this DOS-based operating environment has been in productive use for nearly two and a half years. While this year's release of Windows 3.1 resulted in dramatic gains in performance and reliability, it did not substantially

change the environment's core features.

So unlike OS/2 2.0, Windows 3.1 is a mature environment. The nagging incompatibilities and irritating oversights that inevitably plague a new operating environment have been largely eradicated in Windows 3.1, and developers have had the time to produce a huge and impressive collection of applications, utilities, and device drivers for use under Windows 3.1. This is evident not only in major application areas such as word

processing and spreadsheet programs but also in critical utilities such as tape drive support, backup programs, system diagnostic tools, and system automation tools. Installing Windows 3.1 is remarkably painless. The automated Express Setup reduces installation to a one-step process, even providing optimal disk cache settings. The setup program searches all local drives to identify applications, and it offers to install any or all that it finds as program items in the Program Manager. It automatically recognizes any Windows applications, as well as the more than 175 DOS applications for which it includes rewritten program information files (PIFs). Program Groups created with a previous version of Windows are preserved during the Windows 3.1 installation process, as are all postinstallation configuration changes.

The Windows 3.1 Program Manager accepts drag-and-drop messages from the File Manager, so the user can create new program items at any time by highlighting one or more executable files or documents in the File Manager and dragging them into a Program Manager program group. When a document is dragged into a program group, the Program Manager looks up that document's extension in its Associations list and creates a new program item that launches the application with which the document is associated and passes it the name of the document as a command line parameter.



The extensibility of Windows 3.1's File Manager allows products like Systems Compatibility Corp.'s Outside In to add new functions to the File Manager menu.

from scores of different vendors, Windows 3.1 is the obvious choice for a desktop environment.



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LEASE: \$95/MONTH

Systems Include:†

- 4MB RAM expandable to 32MB
- 105MB IDE, 16ms drive (40MB on 386/SX-25)
- 1.44MB, 3.5" drive
- 1.2MB, 5.25" drive
- 16-bit SVGA, 1MB
- Super VGA color monitor (1024 x 768 resolution)
- 1 parallel/2 serial ports
- 5 expansion slots
- Upgradable processor
- Turbo button and key lock
- 200 Watt power supply
- 101-key enhanced keyboard
- Serial mouse
- MS Windows 3.1 and MS-DOS 5 pre-loaded
- MS Works for Windows pre-loaded (except 386/SX-25)

† Specifications for all Leader systems except 386/SX-25 and 486/25 which have 2MB RAM expandable to 16MB, 16-bit SVGA-512K, 3 expansion slots, non-upgradable processor.

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Windows 3.1 also offers a variety of network-based setup options. Windows can be installed locally from a network server or run from the server with only individual configuration files stored locally. Ironically, this capability is a benefit derived from Windows' not being a true operating system. Because DOS is already running, Windows can sense the presence of network drivers and make use of them. Running on top of DOS also adds to Windows' repairability; the user

Windows includes support for dozens of video drivers, hundreds of printers, and a wide range of other devices.

can work at the DOS prompt to solve a problem that prevents Windows from loading, while in OS/2 a load failure can entirely disable the PC.

Adding to Windows' ease of setup is the enormous number of device drivers with which it ships. Windows includes support for dozens of video drivers, hundreds of printers, and a wide range of mice, sound boards, and other devices. This strong driver support is critical, since configuration difficulties can arise when using Windows with unsupported hardware. Fortunately, Windows' popularity has convinced most hardware vendors to update their device drivers, so even if a driver for a particular hardware device is not included on the Windows installation disks, chances are very good that one is available from the hardware manufacturer.

SUITABILITY TO TASK

Microsoft Windows, Version 3.1

	POOR	FAIR	GOOD	EXCELLENT
Connectivity and multitasking	●	●	○	○
Mainstream business applications	●	●	●	●
Ease of use	●	●	●	●
Mission-critical applications	●	●	○	○
Graphical applications	●	●	●	●

SUMMARY OF FEATURES

Graphical Operating Environments

Products listed in alphabetical order

■ = YES □ = NO

PC EDITOR'S CHOICE

	Microsoft Windows, Version 3.1	OS/2, Version 2.0
Price (single user)	\$149.95	\$195.00
Cost of upgrade	\$79.00	From DOS, \$99.00; from Windows, \$79.00; from OS/2 1.x, free

Hardware Requirements

Processor:		
Minimum	80286	80386SX/16
Recommended	80386	80386
Hard disk space:		
Minimum	6.5MB	15MB
Full installation	10MB	31MB
Memory:		
Minimum	1MB	4MB
Recommended	4MB	6MB
Maximum that can be managed	256MB	4GB

System Architecture

User interface:		
Drag-and-drop support	■	■
File management	■	■
Printing	■	■
Retains status of active applications on exit	□	■
Processing capabilities:		
Protected-mode memory management	□	■
Task switching	■	■
Multitasking:		
Preemptive multitasking:		
DOS applications	■	■
Windows applications	□	■
OS/2 applications	N/A	■
Time-slice adjustment:		
Manual	■	■
Dynamic	□	■
Multithreading support	□	■
Internal 32-bit code:		
Disk access	■	□
Drivers	□	■ (Presentation Manager only)
Graphics engine	□	□
I/O	□	□
Kernel	■	■
Memory management	■	■
User interface	□	■
Communications:		
Maximum asynchronous transfer rate claimed	57.6 Kbps	DOS or Windows: 9.6 Kbps; OS/2: 57.6 Kbps
Maximum asynchronous transfer rate claimed for a background session	57.6 Kbps	DOS or Windows: 9.6 Kbps; OS/2: 57.6 Kbps

N/A—Not applicable: Microsoft Windows is not designed to support OS/2 applications.

CONTINUES

Difficulties can arise through user error. As PC Magazine Labs' Suitability to Task evaluations demonstrated, Windows is unable to recognize when the user has misidentified a printer, or to respond correctly when the user attempts to access a nonexistent network drive. These are not trivial errors, but they should not obscure the highly reliable results that Windows 3.1 delivers when run on correctly configured systems.

THE WINDOWS DESKTOP

The part of Windows that produces the familiar Windows desktop is the Program Manager, which uses easily understood icons for launching programs. Its greatest virtue is also its greatest weakness: The

*If you don't like the way
the Program Manager
is designed you can
replace it with a third-
party alternative.*

Program Manager's icons supply a virtual view of applications and documents that fails to reflect changes in the actual files they represent. An application's icon does not automatically disappear when the application is deleted, and icons do not automatically appear when applications are added to your environment (although the vast majority of Windows applications will create Program Manager icons for you during their installation process).

Windows has been around long enough that if you don't like the way the Program Manager is designed you can replace it with a third-party alternative. Among the more popular Program Manager replacements, The Norton Desktop for Windows adds the ability to create custom menus of applications and drag icons onto the desktop, while hDC Power Launcher provides floating icon bars, a command line utility, and a scripting facility.

Windows manages files via a separate application called the File Manager. The File Manager takes a traditional, tree-oriented view of program launching and

► SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

PC EDITOR'S
CHOICE

Microsoft Windows,
Version 3.1

OS/2, Version 2.0

Applications Support

DOS:		
Full-screen	■	■
Windowed	■	■
Maximum number of multiple sessions	Depends on RAM	240
Multitasking sessions	■	■
Automatically installs PIFs in popular DOS applications	■	■
Configures RAM for DOS session	■	■
Mouse support	■	■
User can change font in DOS	■	■
Closes down hung DOS session without a reboot	■	■
Memory management:		
Maximum conventional RAM available	613K	730K
Maximum expanded RAM available	16MB	32MB
Maximum extended RAM available	16MB	16MB
Maximum virtual memory available	256MB	512MB
Supports DPMI-compliant DOS applications	■	■
Supports VCPi-compliant DOS applications	■	□
Device drivers:		
User can set device drivers differently for each application	□	■
OOS device drivers can be installed during a DOS session	■	■
Reboot not required to activate new drivers in a DOS session	□	■
Microsoft Windows:		
Windows 3.0 support	■	■
Windows 3.1 support	■	□
Real-mode support	□	■
Standard-mode support	■	■
386 Enhanced-mode support	■	□
Full-screen applications	■	■
Windowed applications	■	■
Full-screen desktop	■	■
Windowed desktop	□	■
OS/2:	□	■
OS/2 1.x support	□	■
OS/2 2.0 support	□	■
Full-screen	N/A	■
Windowed	N/A	■
Number of applets included	17	22
Interapplication communication:		
Copy or paste:		
Between DOS applications	■	■
Between Windows applications	■	■
Between OS/2 applications	N/A	■
Dynamic Data Exchange:		
Between Windows applications	■	■
Between OS/2 applications	N/A	■

N/A—Not applicable Microsoft Windows is not designed to support OS/2 applications

CONTINUES



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file and disk management chores. It provides good performance on basic disk and file management tasks, but it lacks extended facilities such as file viewers, customizable menus, or an undelete facility. Fortunately, the File Manager was designed to be extensible, and already several third-party developers have shipped utilities that add new functions

*Some of the applets
shipped with Windows
3.1 range from amusing
to annoying in their
limitations.*

to its menu choices, including Systems Compatibility Corp.'s Outside In (a file viewer), METZ Software's METZ Task Manager (with its user-customizable application launch menu), and Wilson WindowWare's File Commander (which offers user-customizable menus supported by a rich system automation language).

The remaining applets or accessories shipped with Windows 3.1 range from amusing to annoying in their limitations, but few are of real productive value. The Notepad is useful for reading or compos-

SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

PC EDITOR'S
CHOICE

Microsoft Windows,
Version 3.1

OS/2, Version 2.0

Applications Support (continued)

Object Linking and Embedding:		
Between Windows applications	■	■
Between OS/2 applications	N/A	□
Printing queued from:		
Windows applications	■	■
DOS sessions	□	■
OS/2 sessions	N/A	■
Fonts:		
Scalable outline font manager supported:		
Adobe Type Manager	■	■
TrueType	■	□
Number of outline fonts included in package	14	13
Number of graphical fonts	14	5
Number of text-based fonts	10	10

Software Development

32-bit API	□	■
Development tools available	■	■
Applications can share code	■	■
Built-in debugging support	■	■
Interprocess communication:		
Message passing	■	■
Pipes	□	■
Queues	□	■
Semaphores	□	■

Hardware Support

Display adapters supported:		
Hercules	■	■ (as secondary monitor)
CGA	□	□
EGA	■	■
VGA	■	■
Super VGA	■	■ (for full-screen DOS)
XGA	■	■
8514	■	■
Peripheral support:		
Number of printers supported in package	266	205
Number of video boards supported in package	43	6
Number of mice supported in package	5 major mice and all MS-compatible models	6
Drivers available:		
Bermoulli Boxes	■	■
CD-ROM	■	■
Optical storage	■	■
PC speakers	■	■
Plotters	■	■
Scanners	■	■
SCSI controllers	■	■

N/A—Not applicable. Microsoft Windows is not designed to support OS/2 applications.

CONTINUES

PC FACT FILE

Microsoft Windows, Version 3.1

Microsoft Corp., One Microsoft Way,
Redmond, WA 98052; 206-882-8080; fax,
206-936-7329

List price: \$149.95; upgrade from earlier version,
\$79.00.

Requires: 286-based PC or better, 1MB RAM (2MB
recommended), 10MB hard disk space, EGA display or
better, DOS 3.0 or later.

In short: Microsoft Windows 3.1, the current market
leader among graphical operating environments, deliv-
ers good performance with both DOS and Windows
applications, plus compatibility with a broad range of
hardware devices and, thanks to strong third-party sup-
port, an impressive spread of major applications, util-
ities, and development tools.

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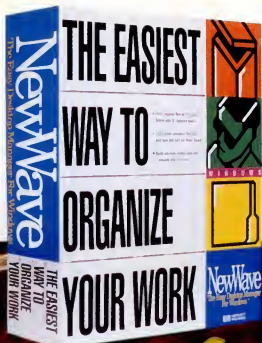
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CIRCLE 073 ON READER SERVICE CARD

ing short ASCII files, and Write is a serviceable entry-level word processor, but Paintbrush is abominably slow, and the Terminal needs a few more emulations and file-transfer protocols to be of any real use.

Windows 3.1 includes multimedia extensions that support digitized audio, and it extends support to them through several accessories, including the Sound Recorder, Media Player, and Control Panel. These can be used to record and play back digitized sound, to link sounds to system events such as Windows startup or critical error messages, and to control multimedia devices such as MIDI sequencers.

**IBM's Windows
compatibility may not
smooth the migration
path to OS/2 but pave
the way for NT.**

None of the Windows accessories match the functionality of OS/2's charting tool or spreadsheet applet, but then they don't need to. Plenty of full-blown applications are available for Windows, so there is less need for lightweight applets that will only frustrate serious users.

AVAILABLE APPLICATIONS

In contrast to OS/2, where it is a struggle to point to even one representative application in each major software category, Windows has a broad and rich range of programs available. Not only do Windows programs exist, in many cases they are the best implementations within a category.

IBM is quick to point out that OS/2 shares Windows' wealth by virtue of its ability to run Windows applications. Yet the better the job OS/2 does in running Windows applications, the less incentive developers have to support the OS/2 API. IBM may find that Windows compatibility does not smooth the migration path to OS/2 but paves the way for NT.

Windows' maturity also gives users a rich hoard of third-party utilities to

SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

PC
EDITORS
CHOICE

Microsoft Windows,
Version 3.1

OS/2, Version 2.0

Hardware Support (continued)

Sound cards	■	■
24-bit color video boards	■	□
Pointing devices supported:		
Graphics tablet	■	■
Joystick	■	■
Light pen	■	■
Mouse	■	■
Mouse pen	■	■
Touch screen	■	■
Trackball	■	■
Number of PC systems certified	1,394	More than 270

Connectivity

Network operating system support available:		
DECnet	■	□
LAN Server	■	■
LANtastic	■	Info not available
LANtastic	■	(8-bit DOS/Windows mode)
Microsoft LAN Manager	■	■
MS-Net	■	(DOS/Windows mode)
NetWare	■	■
Pathworks	■	□
PC-NFS	■	Info not available
10NET	■	Info not available
3+Open LAN Manager	■	■
3+Share	■	(DOS/Windows mode)
TOPS	■	(DOS/Windows mode)
VINES	■	Info not available
Network protocols supported:		
NetBIOS	■	■
	(via API)	
SPX/IPX	■	■
TCP/IP	■	■
Other	IEEE 802.2, 802.3, 802.5	IEEE 802.2, 802.3, 802.5

Product Support

Help and documentation:		
Manuals supplied on-disk	■	■
Number of printed manuals included	2	4
On-line help using hypertext	■	■
Money-back return policy	■	■
Technical support:		
Cost	Free	60 days free, then \$129/year
Hours (eastern time)	12:00-9:00 P.M. M-F	9:00-5:00 M-F
800 number	None	800-772-2227
Bulletin board	CIS	CIS, OS/2 BBS (404-835-6600)

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■ The Windows Programming Experience

by Charles Petzold and
Richard Hale Shaw

Some developers think of Microsoft Windows programming as an exciting adventure; others consider it a nightmare. In truth, it's a little of both.

If you'll take the time to learn its ins and outs, programming for Windows makes possible attractive, interactive programs with a consistent user interface, device-independent graphics, and rudimentary interprocess communication and data sharing.

Most professional Windows developers use an industrial-strength C compiler (such as Microsoft C/C++, Version 7.0, or Borland C++, Version 3.1), although many smaller companies also offer C compilers suitable for Windows development (see our July 1992 stories on C/C++ compilers). In addition, Microsoft and Borland have created entry-level versions of their C development environments (Microsoft Quick C and Borland's Turbo C++) for Windows. Pascal fans can turn to Borland's Turbo Pascal for Windows. All of these packages include the additional files and tools (such as header files and resource-editing utilities) necessary for Windows programming.

With the extensions to Windows for multimedia and pen computing, Windows programmers now have access to over 1,000 function calls with descriptive names such as `CreateWindow` and `Ellipse`. These function calls are located in the DLLs (dynamic link libraries) that make up Windows. DLLs are libraries of procedures that are linked with programs at runtime and can be accessed by several programs at once.

Although dealing with these thousand function calls can be daunting, that's not usually the biggest obstacle to novice Windows programmers. Windows turns traditional structured programming inside out by being based on an "event-driven" (or "message-driven") architecture. In a traditional program, the program calls the operating system when it needs a task carried out. In an event-driven program, the

operating system calls the program to inform it of important events.

Many of these events originate from user input through the keyboard or mouse. But Windows is structured so that programs can handle higher-level events that result from user input, such as selecting a menu command.

Architecturally, Microsoft Windows is based on objects called *windows*—generally rectangular areas on the screen that receive user input and display graphical output. A program usually has a main window; dialog boxes are separate windows, and all the controls in dialog boxes (buttons, list boxes, scroll bars) are also windows.

Each window is associated with a *window procedure*. This is a function that may be located in a Windows program or a Windows DLL. The window procedure is called from Windows to notify it of events that effect the window. These events take the form of *messages*. A window procedure can do something with a message or pass it back to Windows for default processing. For a main application window, for example, default processing within Windows handles all the logic that is associated with menu display and selection. User-input messages are translated into menu-command messages so that the window procedure will be able to handle higher-level messages instead.

This architecture allows specific functionality to be encapsulated into different types of windows. Every window is created based on a *window class* associated with a unique window procedure. Thus, a single window procedure inside Windows handles all buttons that appear in Windows programs.

Windows programs use the GDI

(Graphics Device Interface) for displaying text and graphics on the video display and printer. GDI supports both vector graphics and raster graphics. The same GDI function calls are used for both the video display and printers.

Over the past year, both Microsoft and Borland (as well as some other vendors) have released C++ tools for Windows programming. Microsoft's MFC (Microsoft Foundation Classes) and Borland's OWL (Object Windows Library) are application frameworks for Windows—prewritten code for common Windows pro-

gramming tasks—that free the developer to focus more on the application logic. MFC and OWL differ in their layers of abstraction: MFC is largely a thin wrapping of the Windows API (application programming interface) with nearly 60 object classes, while OWL offers fewer classes but more effectively hides the API from developers.

Aspiring Windows programmers also now have available visual programming tools that provide a way to construct Windows applications without learning the Windows API (see our June 16, 1992, story "The Visual Development Environment: More than Just a Pretty Face?"). Borland's visual tool is *ObjectVision*; Microsoft offers *Microsoft Visual BASIC*. There are third-party products as well, such as *Blue Sky Software's WindowsMaker*, *CaseWorks' Case:W*, and *ProtoView Development's ProtoGen*. With these, you can create your application's interface with little more than a click of the mouse button.

Just as Windows has made it easier for users to work with applications, new tools have made it easier for programmers to create the applications. □

Windows turns traditional structured programming inside out by being based on an "event-driven" architecture.

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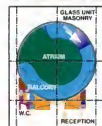
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choose from. There are command line launchers, and those who seek system automation tools in Windows have dozens of alternatives from which to choose—everything from the Rexx-like WinBatch (from Wilson WindowWare) to the graphical hDC Power Launcher (from hDC Computer Corp.).

The paucity of OS/2 2.0 applications prevents any real comparison of the performance of native-mode major applications. Even when Windows and OS/2 ports of an application were available, they weren't always the same version number. Our test results suggest, however, that Windows 3.1 will deliver superior performance on systems with less than 12MB of RAM.

On the basis of PC Labs' performance tests it appears that, at least in terms of throughput, Windows 3.1 is both a better Windows and a better DOS than OS/2 2.0. Windows' performance edge might seem surprising given OS/2's supposed advantage as a 32-bit operating system. But the differences are less clear-cut than they may seem at first, since much of OS/2 2.0 consists of 16-bit code, while Windows 3.1 makes use of generous helpings of 32-bit code and, in 386 Enhanced mode, can execute 32-bit applications.

THE CASE FOR WINDOWS

Windows' overwhelming software superiority will wane in time, of course, as additional OS/2 applications become available, but it is unrealistic to expect that the trend will be reversed anytime in the near future. Thanks to strong third-party support, Windows boasts an impressive spread of major applications, utilities, and development tools. Its current market dominance increases the likelihood that developers will continue to code for it.

In addition to being fast and reliable in running applications, Windows has the advantage of being compatible with a broad range of hardware devices. Its major weakness—its reliance on DOS-based file and network services—will be overcome in the near future with the release of Windows NT (see the sidebar "Windows NT and Beyond"). The strengths of Microsoft Windows 3.1 combine to make it an exceptionally solid choice for a general-purpose desktop environment.

OS/2: The Rewards Of Patience

The most powerful
Intel-based GUI around
lives in a Big Blue box.

By Lenny Bailes



OS/2 has already gained a reputation for itself in large corporate sites as a solid server technology. The memory protection it affords in PC/mini/mainframe multiuser scenarios has recommended OS/2 to MIS managers in mixed-platform environments. *PC Magazine* has found that OS/2 also has some advantages for the single-platform user.

Unlike Microsoft Windows 3.1, which

is a GUI (graphical user interface) that sits on top of DOS, OS/2 is a full-fledged operating system that includes an intelligent and flexible desktop. But although it is an entirely new operating system, you need not discard your old software; OS/2 offers compatibility with three PC operating environments: DOS, Windows, and OS/2. If you begin with an adequate hardware platform and are willing to bear the brunt of short-term installation difficulties, you may eventually find your

patience rewarded with an exceptionally stable and configurable operating environment.

INSTALLATION TRIBULATIONS

For many users, the biggest stumbling blocks to contentment with OS/2 are installation and configuration. During our testing of OS/2 we discovered a surprising number

with IBM technical support.

Although IBM claims that Version 2.0 of OS/2 will work with most non-IBM systems, we found some evidence that many of the problems we encountered do not occur when running IBM software on IBM hardware. In an informal survey of corporate worksites running the IBM Extended Services Database Manager on IBM PS/2 systems, we heard consistent reports of trouble-free installation and no-downtime productivity.

Our primary test-bed for OS/2 was a Compaq Deskpro 386/M with an EISA bus. We also performed some informal testing on a Compaq Deskpro 386 and on a 50-MHz Pan-Pacific 486DX, both with ISA buses. Although the out-of-box installation was routine on the EISA machine, which has an IDE disk controller and a standard VGA graphics adapter, Video configuration was problematic because of a secondary card coreident in the machine. The addition of a secondary monochrome monitor to OS/2's configuration list caused the OS/2 CONFIG.SYS file to be written in a way that conflicted with the use of high-resolution video drivers for the primary video card. A patch was also necessary to allow OS/2



Some DOS apps, like SuperStar, cannot run in OS/2's bundled DOS environment. They require a standalone version of DOS as a separate session.

of glitches. Problems ranging from installation failure to corruption of the OS/2 desktop required repeated consultations

• The OS/2 Programming Experience

by Richard Hale Shaw and
Charles Petzold

Programming for the OS/2 2.0 Presentation Manager (PM) is a lot like programming for Windows, but many differences lie in the details.

Windows was first released in 1985, and when IBM and Microsoft designed the OS/2 Presentation Manager in 1987, they drew a lot from the earlier environment. The windowing and event-driven architecture of Windows were merged with a graphics system developed at IBM.

Given the opportunity to redesign Windows somewhat (and guided by IBM's Systems Application Architecture rules for function-call syntax), the two companies changed all of the Windows messages function calls in various ways.

Programmers familiar with both environments generally consider the OS/2 Presentation Manager API (application programming interface) the more elegant and easier to understand. Function-call names and parameter orderings are more consistent, and windows have clearer relationships to each other. (Unfortunately, the differences between the Windows API and the OS/2 PM API have been a thorn in the side of programmers who wish to support both environments.)

Programmers working with graphics can make good use of the OS/2 GPI (Graphics Programming Interface), which is much more powerful than the Windows GDI (Graphics Device Interface). OS/2's GPI supports complex curves in the form of Bezier splines, rotation and skewing of images using matrix transforms, and PostScript-like "paths" that can be used to create complex areas and clipping regions.

Beneath the Presentation Manager, OS/2 2.0 also contains an extensive operating system kernel that adds both joy and grief to the programmer's life. Memory allocation is simplified enormously thanks to the 32-bit flat memory model. This is much better than

dealing with the 16-bit segmented memory model still found in Windows.

The OS/2 kernel also provides for multithreading. Programs can be split into multiple threads of execution that run concurrently. Generally, a PM program has a main thread that contains its window procedures for handling messages; secondary threads are created to carry out lengthy processing jobs in the background. When used well, multithreading gives the user a big benefit in the form of faster programs (no more hourglass icon!). But designing and debugging a multithreaded application can be quite difficult for the programmer.

The support of HPFS (High Performance File System) under OS/2 2.0 is another area that provides benefits for users: It lets the user assign long file names. Programmers, however, must work to make their OS/2 applications HPFS-aware. The old rules for dealing with DOS filenames are simply not adequate.

Although the Presentation Manager is the primary application environment of OS/2, OS/2 doesn't restrict the programmer to writing for PM. Programmers can write character-mode applications that make use of a healthy collection of function calls for accessing the keyboard, mouse, and video display using IBM's REXX language. The REXX interpreted scripting language provides a powerful alternative to batch files, including string manipulation, arithmetical operations, flow control (loops and if-then-else statements), and an interface to OS/2 and the Presentation Manager.

New in version 2.0 is OS/2's unique object-oriented programming (OOP) facility: the System Object Model (SOM). SOM lets you create reusable objects in procedural languages like C, COBOL, or Fortran without having to use specialized object-oriented languages such as C++ or Smalltalk. IBM plans to make SOM objects binary-compatible with any programming language. At the present time, however,

SOM can only be used with IBM's C/Set 2 compiler for OS/2.

Using the SOM script language, you can define object classes, derive new classes from old ones, hide data and methods, and so forth. Then you compile the script to produce programs in the host language (currently C). The PM API has been extended to include Workplace Shell calls, so you can create objects that interface directly with OS/2's desktop.

Unfortunately, several factors make OS/2 less attractive than Windows to developers. The first is obviously OS/2's smaller installed base and an uncertainty about the operating system's eventual success. The second problem is a dearth of available development tools, though many are on the way. Currently, only IBM has a 32-bit C compiler for OS/2.

While not nearly as polished or as easy to use as DOS and Windows offerings from Borland, Microsoft, and Zortech, OS/2 C++ compilers from Borland and Zortech are on the way. Gpf, Version 2.0, a 32-bit visual development tool for OS/2 2.0, has just been released by Gpf Systems. And MultiScope's MultiScope OS/2 Debugger (a 1989 *PC Magazine* Technical Excellence Award winner) will be available for OS/2 2.0 later this year. Only when a broad base of application development tools are available will new applications for OS/2 really appear in significant numbers.

Another factor is reliability. While certainly stabler than Windows, OS/2 is difficult to install, and once it has been installed, the Workplace Shell occasionally crashes with more or less dramatic effects. Given the stresses that software developers put on an operating system, it will be difficult to ship applications if the underlying operating system is buggy. Nevertheless, OS/2's elegant environment has the promise to be a software developer's dream. It will be largely up to IBM to keep that dream from becoming a nightmare. □

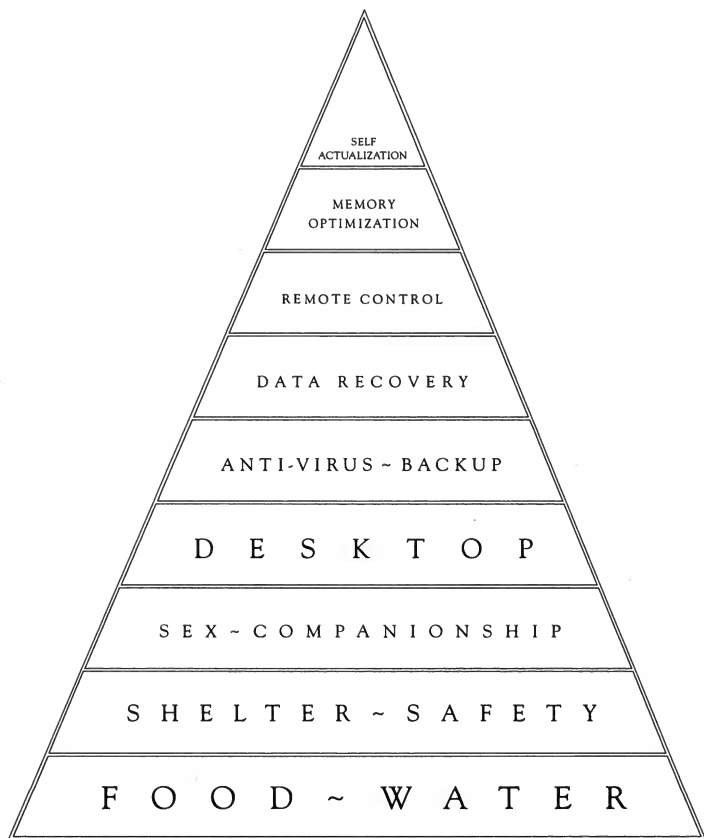
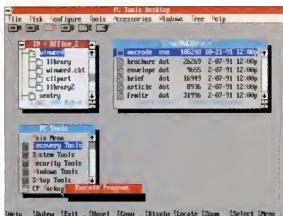
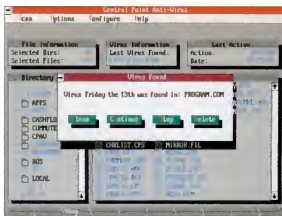


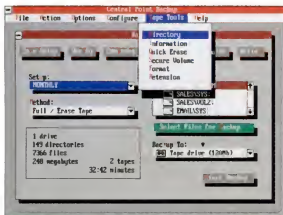
fig. [1]
Maslow's Hierarchy of Needs.



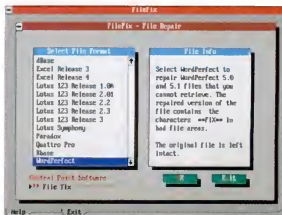
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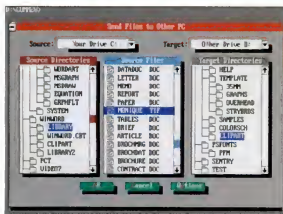
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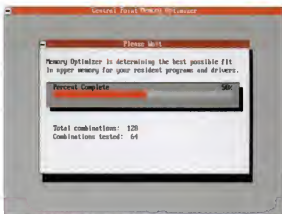
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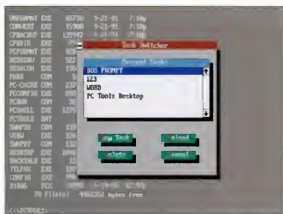
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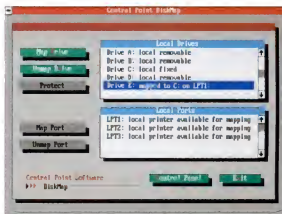
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CIRCLE 079 ON READER SERVICE CARD

■ Windows NT and Beyond

by Charles Petzold

Three years ago, Microsoft's operating system strategy was in a state of confusion. While still committed to OS/2, Microsoft was witnessing a ground swell of interest in the forthcoming Windows 3.0—a product that had begun as barely more than a rogue project. Microsoft told developers to code for the Windows API for low-end machines, use an API conversion layer called WLO (Windows Libraries for OS/2) to move Windows programs to OS/2 1.x, and code for the forthcoming OS/2 2.0 for 32-bit applications.

By the fall of 1990, IBM and Microsoft parted ways: Microsoft was free to extend Windows into the 32-bit realm. Windows had become the industry-standard GUI, despite its technical failings in the current DOS-based implementation and the inelegance of the API. Microsoft began to promote a single-API strategy, succinctly summed up by the phrase "Windows Everywhere."

This strategy envisions Windows as a scalable architecture that straddles a broad range of hardware platforms, from hand-held pen-based computers to powerful RISC-based multiprocessor servers.

The strategy is simultaneously ambitious, megalomaniacal, and extremely seductive to software developers. Write your programs for Windows, Microsoft says, and your applications will eventually be runnable on (or port-

able to) many different platforms. The developer's investment in Windows is preserved, and so is the user's.

Already Microsoft has released extensions to Windows for multimedia (which were incorporated into Windows 3.1) and pen-based computers. Windows for Workgroups, which should be released by the time you read this, adds integrated networking and electronic mail to the current Windows 3.1 product.

Then there's Windows NT. The NT project began at Microsoft in 1988 as OS/2 3.0, with a redesigned and rewritten 32-bit kernel for portability to processors other than Intel's. Following Microsoft's abandonment of OS/2 and the Presentation Manager in late 1990, NT became known as Windows NT—an operating system incorporating a 32-bit superset of the Windows API. Windows NT (available only in a beta "developers' prerelease" at the time of this writing) will compete head-on with both IBM's OS/2 2.0 and Unix.

Windows NT is a 32-bit operating system from the ground up, unlike OS/2 2.0, which still contains much 16-bit code. Like Unix, Windows NT has been written for portability. The developers' prerelease contains versions for both 386/486 machines and the MIPS R4000 RISC chip. Like OS/2 2.0, Windows NT supports preemptive multitasking and multithreaded applications. Going beyond OS/2 2.0, Windows NT also supports symmetric

multiprocessing, which means that it can run on a machine with multiple processors and assign different threads to different CPUs.

The primary user interface under NT is a 32-bit version of Windows with an API known as Win32. Win32 is a 32-bit extension of the current Windows API, with significant enhancements. In converting the Windows API to a 32-bit flat memory model, the NT developers had to eliminate some function calls (such as those pertaining to EMS) and modify others. But for the most part, Win32 function calls have the same syntax as Windows 3.x. Judging from early reports, it's relatively easy to convert existing Windows code to the 32-bit Windows NT API.

The Graphics Device Interface (GDI) of Windows NT has been enhanced to support many of the advanced features found in the OS/2 Graphics Programming Interface (GPI). In some cases the Win32 GDI comes close to the standards set by GPI; in some cases it exceeds GPI capabilities. For example, the Win32 GDI supports bitmap rotation, while GPI does not.

Windows NT supports Unicode, a new emerging standard in which character glyphs are represented by 16-bit values rather than 8-bit bytes. This allows programs to store and process character strings using all the glyphs of the world's written languages without the awkwardness of code pages as

On the 486, OS/2 also failed to recognize LPT1, which made printing impossible. An in-house IBM document warns that "cheap" cables, or I/O adapters that do not generate hardware interrupts, may fail to function correctly under OS/2, even though they work under DOS. We substituted a fully wired 25-pin-to-25-pin Centronics cable, but we were still unable to print from either of the two parallel ports installed in the 486 clone. Only when a post-1990 I/O card was installed

An installation utility migrates most of your installed DOS and Windows programs automatically, placing them only a mouse click away. But we found that the system had to be tweaked to work smoothly with some DOS and OS/2 applications. For example, the DOS-based Lotus 1-2-3, Release 3.1, required a special set of parameters to be entered in the DOS settings box. DOS telecommunications programs may have difficulty recognizing serial ports above

the background on any port.

A few packages remain incompatible no matter what. Since it lacks support for VCPI (virtual control program interface), OS/2 cannot run DOS programs such as AutoCAD (Release 12), IBM Interleaf, and Mathematica for DOS, and the DOS versions of graphics packages such as DrawPerfect and Harvard Graphics are unacceptably slow in windowed sessions. Windows programs that run only in Extended mode (like Mathe-

implemented in DOS and OS/2.

Another significant change involves multitasking. The type of multitasking implemented in Windows 3.x is non-preemptive; Windows does not switch between Windows applications based on the system timer, but instead switches when applications make certain function calls to poll for user input. OS/2 2.0 implements preemptive multitasking, but with a profound limitation in Presentation Manager programs: User input is serialized, which means that PM requires an application to finish processing a keyboard or mouse event before passing subsequent user input events to other applications. For this reason, it is recommended that PM programs use secondary threads of execution to carry out any long processing jobs. But secondary threads are limited in the PM function calls they can make.

Windows NT has a serialized user input model. Even if an event requires a long time to process, the user can still switch control to another application. NT programs can also create secondary threads of execution without many of the restrictions that PM imposes.

Another problem that Windows NT seeks to solve involves memory protection and cleanup. Because Windows programs share a lot of system resources, memory in Windows 3.x dynamic link libraries is often shared among applications. This means that Windows programs can affect each other by inadvertently altering shared memory. The problem is compounded by Windows 3.x's inadequate implementation of protected mode, in which

Windows and all Windows applications share the same virtual address space. Also, Windows does not have the ability to clean up after applications properly; a program can cause Windows to allocate memory for resources that will stay allocated after the program terminates.

According to the design goals and specifications of Windows NT, it will not be possible for one Windows NT program to affect another or to leave behind allocated memory. Nor will NT allow programs to access hardware directly.

This intended rock-solid, crash-proof stability of Windows NT will be ideal for mission-critical applications. NT will also be good news to companies that deal with the federal government, since it's intended to meet standards for POSIX compliance and achieve a C2-level security certification. But NT's security features will probably entail a performance penalty, and they are the reason that not all DOS and Windows 3.1 applications will run under NT.

To straddle the gap between Windows 3.1 and Windows NT, Microsoft offers Win32s. (The *s* stands for *subset*.) If a 32-bit NT program uses only those function calls that are also supported under Windows 3.1, then the executable will run under Windows 3.1 with the help of some dynamic link libraries for converting between the 32-bit calls and the 16-bit Windows API.

NT is slated for release in early 1993, and Microsoft is betting the farm that it's one step forward in the "Windows Everywhere" strategy. □

matica) cannot be run, since OS/2 supports Windows only in Standard mode.

To date, IBM offers users scant support for high-resolution graphics applications under OS/2. The only drivers now available for running OS/2 programs in video resolutions above standard VGA are XGA drivers—IBM's own standard. Out of the box, OS/2 can only run Windows in standard VGA resolution at this time. You can run Windows in SVGA resolution if your video card vendor supplies the driver.

Although network users running

IBM's LAN Manager report flawless performance under OS/2, *PC Magazine* encountered glitches with Novell's Network Requester package. Workstations logged off the network by the administrator persisted in trying to access "ghost drives," which caused users' systems to hang without warning.

IBM has issued a number of patches to address these and other problems. The patches are available on IBM's OS/2 BBS in Atlanta, on CompuServe, and on many public BBSs. An upgrade, which is supposed to be released by year's end, will

provide additional video driver support and compatibility with Windows 3.1.

THE FLEXIBLE WORKPLACE SHELL

Once you have OS/2 2.0 installed and booted up, the first thing you'll probably notice is the lack of a pull-down menu across the top of the screen. The OS/2 desktop—called the Workplace Shell—is object-oriented in design. Program environment configuration, the arrangement of icons, and printing are managed by pointing at strategic desktop objects and clicking the right mouse button. Cosmetic changes such as font and color settings are implemented simply by clicking and dragging your selection from a palette to the area of the desktop you want to customize. This approach may baffle Windows users at first, but if you remember to try both buttons when you're looking for a feature, you will soon appreciate the easy accessibility.

Although its multiplicity of features make it harder to learn, the Workplace Shell offers much greater flexibility in customizing the interface than does Windows. OS/2's tear-off template approach to creating data and program objects is flexible and useful, but entails a steeper learning curve than Windows' rudimentary file-association technique. OS/2 also includes REXX, a powerful batch programming language. In the hands of a skilled MIS manager, REXX can be used to build a wide range of turnkey options.

The Workplace Shell includes a good collection of easy-to-use *applets*—or mini-applications—to enhance productivity. The applets bundled with OS/2 cover more territory than the set included with Windows. You get a desktop presentation and charting tool, database manager, spreadsheet, calculator, cardfile, clipboard, notebook planner, and two text editors, in addition to a host of other Win-

SUITABILITY TO TASK

OS/2, Version 2.0

	POOR	FAIR	GOOD	EXCELLENT
Connectivity and multitasking	●	●	●	○
Mainstream business applications	●	●	●	○
Ease of use	●	●	○	○
Mission-critical applications	●	●	●	○
Graphical applications	●	●	●	○

dows-like accessories. There's even a tune editor to let you compose and save simple musical compositions.

OS/2 offers a multimedia extension package (MMPM/2) for an additional price. A single-user license is \$125; additional licenses cost \$99 per user (available only on 3.5-inch disks). The developers' version, available only on CD-ROM, costs \$199 for a single user and \$152 for each additional license. OS/2's multimedia package has features comparable with those built into Windows 3.1 at no additional cost, but OS/2's multithreaded architecture makes for better audio/video synchronization.

Three applets are particularly useful. The Spreadsheet, though limited to 80 rows and 26 columns, can be used as a scratch pad for preliminary data entry, or for displaying a selected range from a more powerful package. The Database allows 5,000 eight-line records and contains a telephone auto-dialer. PM Chart, a graphics program from Micrografix, is the real star. It doubles as a rudimentary desktop presentation tool, and it can be used to construct word charts (text charts with no data) or to graph spreadsheet data in addition to editing bitmaps. If you don't want to start from scratch, you can import clip art, charts, and spreadsheets developed elsewhere.

A TURN AROUND THE TRACK

A particularly nice design feature of the Workplace Shell is evident whenever you restart your system. Unlike Windows, OS/2 automatically reopens OS/2 applications and DOS or Windows sessions that were active when you shut down. For native OS/2 programs, the system also reloads open document files. The automatic reopen feature is different from the startup folder feature, which both OS/2 and Windows provide.

There is a dark side to this advantage. Although OS/2's protected-mode architecture should provide safeguards, we found that crashes in individual windows occasionally managed to take down the entire system. Even when OS/2 crashes, the status of the desktop and the applications that are open are written to disk and then restored when you reboot. If the ill-behaved application interferes with proper rebooting, you must turn this feature off, at least temporarily.

Most software in use today is DOS- or Windows-based, since there are few OS/2 applications available—and even fewer 32-bit OS/2 2.0 applications. While OS/2 can run 16-bit Windows applications under Windows 3.0, *PC Magazine's* performance tests indicate that Windows 3.1 will run them faster. (As mentioned above, IBM promises support for Windows 3.1 by January 1993.) There was only one 32-bit OS/2 application available for testing—DeScribe 32-Bit Word Processor—and it did outperform its 16-bit Windows counterpart. As increasing numbers of optimized, 32-bit OS/2 applications appear on the market, Windows' speed advantage should evaporate.

OS/2 1.x applications will run under OS/2 2.0 but do not take full advantage of its features. Although the selection is limited, there are OS/2 1.x applications in all the major areas: IBM Extended Services' Database Manager; 1-2-3 and Microsoft Excel (spreadsheet packages); CorelDRAW, Lotus Freelance for OS/2, Microsoft Word, and Ventura Publisher (desktop publishing and graphics).

If your favorite application is not available under OS/2, you can usually run the DOS or Windows version in a dedicated box. OS/2 runs standard DOS and Windows applications such as dBASE, Excel, 1-2-3, Microsoft Word for Windows, and WordPerfect smoothly if a bit slowly. But if you install OS/2's new file system, HPFS (High Performance File System), rather than the FAT (file allocation table) system used by DOS, you will be dependent on OS/2-specific software for disk-intensive applications such as disk compression, backup, and antivirus utilities. While OS/2-based disk compression and backup utilities exist, we do not know of a product that can remove viruses from an HPFS-formatted disk.

WHO SHOULD BUY OS/2?

Certainly OS/2 will appeal to users on mixed-platform networks who regularly need access to large databases. For shops that must access IBM AS/400 or RS 6000 servers, IBM offers Distributed Database Connection Services/2 (\$4,680 for the server version), which provides transparent connectivity to DB2 databases on a wide range of larger computers.

Power users who want extensive control over the performance and appear-

ance of their desktops will appreciate OS/2's powerful object-oriented interface. And system managers familiar with BASIC-like languages can easily pick up enough REXX to construct a wide range of configurations for an entry-level user, or to automate complex, repetitive tasks to run with minimal user input.

Programmers will also appreciate OS/2's memory protection. When you are developing applications under DOS or Windows, a wild pointer can easily crash the operating system and force you to reboot. With OS/2, the problem is contained within the development window, which can simply be shut down. When you multitask applications, you enjoy the same benefit: Once OS/2 is configured properly, a misbehaving application will not bring down your whole system.

Finally, you don't have to give anything up to take advantage of OS/2's features. Since most DOS and Windows apps will run under OS/2, OS/2 gives you three environments in one. The only penalty is a rather arduous installation and configuration process. OS/2 1.x users can upgrade to Version 2.0 at no cost.

After working within OS/2 long enough to gain control of the system, returning to Windows is like getting back behind the wheel of a less powerful car with a much simpler dashboard. Some people may prefer simplicity, but others will miss the extra power hidden under the OS/2 hood. □

FACT FILE

OS/2, Version 2.0

IBM Corp., Old Orchard Rd., Armonk, NY
10504; 800-342-6672, 800-426-2468

List price: \$195. Upgrade from OS/2 1.x, free; upgrade from DOS, \$99; upgrade from Windows, \$79.

Requires: 386SX/16-based PC or better (386DX/33 or better recommended), 4MB RAM (8MB recommended), 40MB hard disk space (80MB recommended), EGA display (VGA recommended).

In short: OS/2 is a high-performance operating system that supports DOS and Microsoft Windows applications in addition to native OS/2 applications. Its demanding hardware requirements and the technical difficulties of its installation and setup recommend it mainly to users with a specific need for its special capabilities.

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Presentations

With Style, Substance and Splash



It has never been more necessary to provide visual support for your presentations. One of these eight packages can carry you from conception to execution.

by *Angela Gunn*

No more than a year ago, we considered presentation graphics products a relatively mature category, in which both the needs of the users and the "appropriate" feature sets of the packages were clearly delineated. Now it seems as if the category has lapsed back into adolescence, growing quickly and awkwardly. This rejuvenation in the field of presentation products can be attributed in large part to software and hardware that support sound, video,

and animation, and to a lesser extent, the growing base of users who have more sophisticated data-charting needs. In addition to expanding the vision of what a presentation should contain, we've seen

new life pumped into the traditional packages resulting from the growing need for software that is easier to use and that makes you more productive.

The twin infiltrations of CD-ROM and laptops have stimulated adventurous designers to start thinking about computer-based multimedia presentations. Thanks to hardware en-

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Presentation Graphics

hancements, sound, video, and animation have become desirable elements for many mainstream presenters. At the same time, technical users who previously might not have considered using "artsy" software to present their data are asking for packages with the ability to create both complex data charts and good-looking graphics.

Since we last reviewed this category less than a year ago ("To Inform and Convince," March 17, 1992), presentation graphics software has continued to take advantage of increased desktop firepower. Windows has solidified its standing as the dominant graphics platform. But while the core functionality of the products in this category has remained solid and has even matured, an interesting evolution pushes these products in some new directions.

The packages we review reflect this momentary chaos in the presentation graphics market, each focusing on slightly different types of users. Nevertheless, all of the packages reviewed here perform a core set of tasks. First and foremost, each package has some central slide-creation and organization metaphor that make it possible to achieve a consistent look across a presentation. In addition, each supports direct or imported text entry into preformatted word charts—packages requiring the user to work with free-form text labels were excluded—and data-chart creation. The packages also support some sort of scalable outline font such as Type 1, TrueType, or Speedo. We also required that packages be capable of importing vector clip art and that they supply basic drawing tools for chart annotation and diagram creation. And we reviewed only products that have been updated since our last roundup, with one exception detailed below.

This decision trims our latest look at the presentation graphics field to a diverse group of eight products: Aldus Persuasion, from Aldus Corp.; Claris Hollywood, from Claris Corp.; DeltaGraph Professional, from DeltaPoint;

Freelance Graphics for Windows, from Lotus Development Corp.; Harvard Graphics for Windows, from Software Publishing Corp.; Microsoft PowerPoint, from Microsoft Corp.; SoftCraft Presenter, from SoftCraft; and Stanford Graphics, from 3-D Visions. Although Freelance has not been upgraded, it was included because of its status as our last Editors' Choice winner.

Though it was not a criterion of this review, all eight packages are Windows-based. Graphic Impact (\$149), from Autodesk Retail Products, also met these requirements, but was later dropped after a serious bug made it impossible to complete our testing satisfactorily. Autodesk has replicated the problem and is working on a correction.

The timing of our article caught a few pitchers still warming up in the bull pen. The DOS version of Harvard Graphics and both the DOS and Windows versions of WordPerfect Presentations 2.0 (née DrawPerfect) were all in beta testing during our review period. We obtained prerelease copies of these packages and give you a preview of their features in the sidebar "Coming Attractions."

Finally, although the latest version of CorelDRAW has added many presentation graphics-like features, including data charting, templates and a screen-show utility, at heart it remains an illustration package. (For more information on CorelDRAW 3.0, see First Looks in the August 1992 issue.)

BEYOND THE BASICS

Other offshoots to the more traditional presentation graphics packages—packages geared primarily to the creation of data, text, and graphic slides for hard-copy output—are also starting to make their presence known. Programs de-

signed mainly for desktop presentations—Animation Works Interactive (from Gold Disk), Madison Avenue (from Eclipse Technologies), and Action! (from Macromedia), among many others—import data charts and drawings from other packages and jazz them up for show time by adding animation, full-motion video, or other capabilities. (For a review of Animation Works Interactive and Action!, see "The Motion is the Message" in the August 1992 issue.)

Such packages might be used in conjunction with a presentation graphics package, and are nominally in a category by themselves. This time next year, this division may no longer exist; traditional presentation graphics packages are quickly beefing up their support for a

growing variety of media. For instance, Harvard Graphics for Windows now includes support for the multimedia capabilities built into Windows 3.1, and many of the other presentation graphics packages we saw include at least rudimentary support for animation and sound. SoftCraft Presenter has powerful and extensible animation capabilities. So, if your presentations require heavy-duty multimedia support, don't automatically discount the abilities native to the packages in our reviews.

On the other hand, two of these products, DeltaGraph Professional and Stanford Graphics, are descendants of full-blown technical charting packages and offer serious scientific plotting and data analysis abilities. Their special charting templates—polar charts, radar charts, surface plots, and the like—might puzzle the average user but serve the needs of the scientific community. (For a sampler of data chart types, see the sidebar "A Guide to Data Charting: Breaking Out Beyond Bars.") The evolution of these packages into mainstream contenders is a nod to the demands of the scientific market, which needs attractive ways of presenting its information as much as the next group. Expect to see these packages evolve and (we hope) integrate their

Our Contributors: ROBIN RASKIN is an executive editor of PC Magazine.

SHERYL CANTER is an associate editor of PC Magazine. GAYLE C. EHRENNAN and ANGELA GUNN are staff editors of PC Magazine. ROCK MILLER is a frequent contributor to PC Magazine. LENNY BAILES is a California-based free-lance writer and an occasional contributor to PC Magazine.



EDITORS' CHOICE

- **Freelance Graphics for Windows**
- **Microsoft PowerPoint**

technical and presentation personalities more effectively, but don't expect to see these niche-oriented capabilities fully realized in every presentation graphics package.

The other packages in our review focus on a smaller selection of mainly business-oriented charts, and more fully develop their other assets. Most of these packages were originally conceived as slide generators, and like the graphics studios of yore, they are set up to make attractive images with provided data. These packages have evolved by, among other things, improving their data import abilities; over time, presentation graphics packages have incorporated first data import, then data-linkage, and now DDE (Dynamic Data Exchange) and even OLE (Object Linking and Embedding).

MAKING A SELECTION

In all cases, quick ramp-up time is key to successful use, since presentation products tend to be used less frequently than mainstay applications, and since there are often stretches of time between their use. Products must be easy to learn and easy to use. Tutorials, both on-line and written, are important, as are attractive and useful templates for the basic kinds of slides (text and data charts). The majority of slides in the majority of shows are word slides, generally bulleted lists. Packages need robust text-handling facilities, including scalable fonts, a variety of typefaces, and text-fitting capability, as well as some useful metaphor for processing this text.

All but one of the packages included in this review use some sort of outliner for viewing slide text. At the very least, the outliner may be no more than a title sorter that you can use simply to rearrange your slides; at the very most, with an outliner such as the one in Persuasion, you can generate an entire presentation without ever changing from outline view to slide view.

Beyond that, font handling should take into account both slide presentations and printed copy; after all, the most common format for the output of these packages is printed handouts, and even slide shows are usually accompanied by some sort of paper-based visual guide. Recent studies are beginning to show that

Each of the presentation graphics packages reviewed here is a rose: While appreciating its beauty, you're going to bloody your hands a bit on the thorns. All the products offer important strengths, from ease of use to especially strong technical chart-

ing. But every one of them also exhibits irritating weaknesses.

Freelance Graphics for Windows (\$495) remains one of the strongest packages for the novice user. Freelance's attractively designed SmartMasters guide you through the text, data, and clip-art entry process, allowing you to generate slides quickly. But the underlying architecture of these SmartMasters is confusing enough to make editing them frustrating.

Microsoft PowerPoint (\$495) is another exceptionally easy product to use. Though its master system is far less ambitious than Freelance's, the tools provided—such as the Style Dropper—ultimately render it the more flexible of the two packages for the design-as-you-go user. If data charts make up a large part of your presentations, however, PowerPoint's OLE-server charting engine may drive you to distraction. When we finally see in-place editing of OLE objects, relying on an OLE server for such a fundamental function may be the right solution; for now, the constant jumping back and forth while you're fine-tuning a chart is awkward.

With its superior outlining capabilities, Aldus Persuasion (\$495) remains the best product for producing long, text-intensive presentations, and its excellent import facilities, sophisticated masters, and bulletproof output make it a strong product for more graphically minded users. Its weak data handling and steep learning curve undercut its usefulness.

More than any other product on the market, SoftCraft Presenter (\$595) unites the worlds of desktop

presentations and traditional presentation graphics. The package can generate data-driven animations—a giant step beyond the flying bullets offered by the competition—in addition to being able to handle hard-copy output like a pro. Unfortunately, its data charting is just adequate, and its animation architecture daunting.

Harvard Graphics for Windows (\$595) and Claris Hollywood (\$499) create presentations adequately but quirkily. Although well behaved for simple text and data entry, many operations in Harvard failed to work as expected. Hollywood's steep learning curve and output problems are not quite offset by its strong data-charting and drawing tools.

Technical presenters—those requiring specialized chart types and packages that can handle large data sets—have long been neglected by presentation graphics products. Although they offer powerful charting and novel features, DeltaGraph Professional (\$495) and Stanford Graphics (\$495) offer problems galore.

DeltaGraph's data notebook, multipage data sheets, and use of drag-and-drop libraries are state of the art. But these advanced features hardly compensate for the frequent crashes and severe output problems we experienced. Similarly, features such as the Graphic Equalizer, which provides an interesting way to play visual what-if games with your data, don't even begin to justify the effort of wading through the convoluted architecture or the number of bugs we encountered while testing Stanford Graphics, the more technically ambitious package.

Suitability to Task: Presentation Graphics Software

Most of the products we review here do a satisfactory job of generating typical presentations. But each has different strengths that you should match with your specific needs.

Many users of presentation graphics packages do not use a presentation product very frequently—certainly not frequently enough to maintain a high level of skill. **Quick/inrequent presentations** evaluates a package's usefulness to a first-time or infrequent user. To receive a good score, a package should be easy to learn, easy to use for creating attractive presentations quickly, and easy to pick up again after a hiatus.

Text charting forms the core of most business-oriented presentations, because it allows a presenter to underscore the essence of a verbal message visually. The speed, ease, and flexibility with which text can be arranged and formatted are fundamental measures of a package's prowess.

Two or three years ago, people considered presentations and data charts more or less synonymous. While that is no longer the case, **data charting** still makes up an important component of most presentations. The breadth and types of automatic charts, the flexibility of data import, linking, and manipulation; and the potential for customization are the fundamental issues to ponder when evaluating a package's data-charting abilities.

Notes, comments, labels, arrows, pointers, and illustrations can add impact to even the handsomest charts. For this reason, presentation packages come equipped with **illustration and annotation** tools (and clip-art libraries) to simplify the task of enhancing their basic output. Flexibility of file importing, ease of color handling, and usability of the drawing tool set are of primary importance.

An effective method of displaying the fruits of a presentation creator's labor is the screen show, where images are displayed on the PC's screen.

judiciously used animation and transitions can significantly increase your impact as a presenter: If you are turning to laptop-based presentations, the desktop presentation capabilities of a product are crucial. These screen show capabilities include a mechanism for distributing your presentation, be it Freelance's DOS run-

SUITABILITY TO TASK				
Product Name				
	POOR	FAIR	GOOD	EXCELLENT
Quick/inrequent presentations	☐	☐	☐	☐
Text charting	☐	☐	☐	☐
Data charting	☐	☐	☐	☐
Illustration and annotation	☐	☐	☐	☐
Desktop presentations	☐	☐	☐	☐
Hard-copy presentations	☐	☐	☐	☐
Presentation management	☐	☐	☐	☐

Desktop presentations evaluates the degree of control a user has over the duration and sequence of the display (hyperlinks are a big plus) and the selection of transition effects between images. Runtime screen shows, which don't require you to launch the entire application, definitely add value.

Hard-copy presentations evaluates the quality of 35-mm photographic slide (imaged at service bureaus), color PostScript, and monochrome laser output. Laser printing can include full presentation pages or reduced images ganged on a page as handouts or speakers' notes. Not all packages deal equally well with the demands of interfacing with a variety of output devices; the ability to switch among them transparently with little or no page reformatting is a huge time-saver and is almost as important as the attractiveness of the output.

Presentation management rates the balance between the details (individual pages or slides) and the larger picture (the overall flow of ideas). A well-designed presentation product should allow users to move freely among a single-page view and a thumbnail view that shows all the slides in order; in addition, a text-only (or outline) view seems to be the most productive approach for facilitating strong presentation structure. The ability to create handouts and speakers' notes quickly and easily, as well as switch among multiple output devices, are also important considerations.

time maker or PowerPoint's included Windows playback utility.

All eight packages in this review are able to import data from a variety of spreadsheet formats; most are able to maintain a "live" link to the external sheet, and most also allow manipulation of the data within the graphics package.

(This last ability is handy if, for instance, you need to chart only a portion of a linked spreadsheet.) The best packages also allow users to select discontinuous data on a spreadsheet and graph it without needing to reformat the spreadsheet.

Graphics are integral, though many infrequent users will do little more than choose an attractive template and add a bitmapped company logo or interesting clip art. However, these packages are generally capable of fairly sophisticated illustration, including color handling and the ability to draw Bezier curves.

To evaluate these packages, we used essentially the same procedures we followed the last time we looked at these products, with a few enhancements designed to test the technical and artistic capabilities of the packages more fully. (For a description of the testing methodology, see the "How We Tested" sidebar on pages 166 and 167 of the March 17, 1992, issue.)

Which package will work best for you? Consider your level of design experience (with and without computer-based graphics packages), the types of slides you need most, and the way you mentally organize information when looking over presentation graphics packages. Users who need to create a wide array of scientific charts will want to consider Stanford Graphics or DeltaGraph. Users with a serious commitment to the DOS version of Harvard Graphics (currently the market leader in this category) or Microsoft PowerPoint may wish to stay with a package that maintains compatibility with those programs' file formats.

Choosing a package that works in a way that matches how you think will smooth out the development process considerably. If you need to see all your slides at once in order to organize them, any package with a slide sorter will suit you, but if you need to focus on words you will want full-fledged outliner or simple title-sorter capabilities. And if your presentation requires multimedia support, you'll want to look at Harvard Graphics for Windows and SoftCraft Presenter before making your decision.

While none of these packages is perfect, they are all perfectly capable of generating a typical presentation. Whichever one you decide on, it is bound to be an effective tool for making your point.

Aldus Corp.

Aldus Persuasion

BY LENNY BAILES

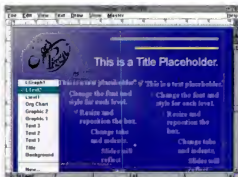
Aldus Persuasion is a well-integrated package that is thoughtfully designed to give the user complete control of a presentation's appearance. Persuasion 2.1, retailing for \$495, offers a separate runtime slide viewer and the ability to link data charts to Microsoft Excel and Lotus 1-2-3 spreadsheets. However, the package's bare-bones Data Manager still lags behind the other sophisticated features of the program.

Persuasion makes it easy to work with text and graphic elements, both globally, in its outliner, and locally, in individual slides. Using the standard Windows pull-down menu interface and PageMaker-like pasteboard metaphor, the package offers several alternative ways to build a presentation. Persuasion's multiple slide master approach to layout is a bit complex, but new users will be able to crank out presentations by selecting from a wide variety of "autotemplates." Each autotemplate contains a set of preformatted text and graphics slide masters. You can apply these autotemplates to individual slides, or tag them to text entered in the outliner. Bulleted text and data charts fall into place automatically on each slide when tagged with an appropriate slide master style.

Persuasion's long suit is its full-featured outliner/word processor. When you open a new presentation, the package starts you in the outline view (you can also choose to default to slide view). The preferred way to create slides in Persuasion is to type text into the outliner or to import chart contents from a word processor file. The package's Smart-ASCII import feature makes it easy to preserve the hierarchical structure of your text when placing it into the outliner. Most PC

word processing formats can also be imported. While slide templates and elements can be placed from within the outliner, you can also jump into individual slides to place charts, set backgrounds, and import graphic images.

Persuasion's slide masters contain placeholders that automatically format text or chart data entered in the outliner.



Aldus Persuasion's preformatted slide masters allow the user to produce multiple-column bulleted text charts with ease. Break points indicated in the outliner automatically flow chart text to the appropriate placeholder.

Placeholder contents are bidirectionally linked with the corresponding entries in the outliner. This link allows you to make your changes directly on the slide and have them automatically updated in the outliner, and vice versa. By choosing an appropriate slide master, it proved easy for us to create the

two-column bullet charts included in our test presentation. In addition, the package supports up to six levels of indented bullets.

Unfortunately, if you print with the included MagiCorp slide driver, you don't get access to the TrueType Symbol or WingDings fonts. Because of this, our bullet choices were limited to what was available in the primarily alphanumeric fonts the package includes in its bundled version of Adobe Type Manager.

Persuasion offers a variety of data chart types and great flexibility by allowing you to manipulate the individual chart elements. Again, a series of predefined chart styles shields the novice user

SUITABILITY TO TASK	
Aldus Persuasion	
	POOR FAIR GOOD EXCELLENT
Quick/inrequent presentations	● ● ● ●
Text charting	● ● ● ●
Data charting	● ● ● ●
Illustration and annotation	● ● ● ●
Desktop presentations	● ● ● ●
Hard-copy presentations	● ● ● ●
Presentation management	● ● ● ●

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■ Coming Attractions

by Gayle C. Ehrenman

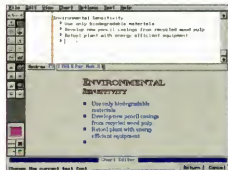
Time waits for no man, nor for any presentation graphics package. DrawPerfect (WordPerfect Corp.; Orem, Utah; 801-225-5000) and Harvard Graphics for DOS (Software Publishing Corp.; Santa Clara, California; 408-986-8000), two packages that were left behind when others in the category revamped, are now busy playing catch-up. New versions of these packages, and in the case of DrawPerfect a new name (WordPerfect Presentations), and a new sibling should help them reenter the race.

WordPerfect's presentation graphics product has undergone more than just a name change. Where DrawPerfect was a single DOS-based package, it has now given way to twins: WordPerfect Presentations for DOS and WordPerfect Presentations for Windows. The DOS product, in beta testing at the time of this writing, should be available by the time you read this. The Windows product was not yet in beta at the time of this review; both will retail for \$495.

These two packages share more than a name; they share an almost identical easy-on-the-eyes graphical interface, which features pull-down menus, and the same customizable button bar as WordPerfect for Windows. The DOS package also supports familiar WordPerfect keystrokes. Both packages now offer a slide sorter for viewing an entire presentation and reordering slides by simply clicking and dragging and a slide editor for creating and manipulating individual slides.

When you launch WordPerfect Presentations for DOS, you're immediately kicked into drawing mode. To create a presentation, however, you'll have to use the menus first to change to presentation mode. (With the Windows product, you're always in presentation mode.) Whether creating or editing a slide, you're presented with a split-screen view. For bullet and text

charts, you see an outline on the top of the screen and the slide on the bottom of the screen; for data charts, the outline is replaced with a spreadsheet. While you can't edit directly on a slide, which is a bit of an inconvenience, the split-screen approach gives you an opportunity to preview your changes as you make them (and undo them if nec-



WordPerfect Presentations still does not have in-place editing for text slides, but it does give you a WYSIWYG view of your text in a split screen. The product improves on DrawPerfect's interface by using iconic toolbars.

essary), without first changing views.

In addition, WordPerfect Presentations for DOS now offers support for Type 1 fonts, 20 popular sound cards—ships with over 100 MIDI sound clips—and includes a gallery of easy-to-use, editable slide templates. Also new is the spreadsheet-like data entry sheet that allows you to perform calculations on your data, gives you the ability to import data from a wider variety of other programs, and provides a newly expanded variety of chart types to choose from. Area, organization, and surface charts, as well as tables, are among the recent additions to the charting gallery.

WordPerfect Presentations has also made it easier to create colorful presentations. The latest version of the package offers more sophisticated color handling, including the abilities to create custom palettes of 256 colors, specify gradient fills on objects and text, and print to a wider array of color print-

ers. The painting and drawing tools have improved, too. You can now create, edit, and trace bitmaps; blend objects; create regular polygons, closed curves, freehand objects and rounded rectangles; and place arrowheads as line ends. More important, you can resize and move the objects you create by clicking and dragging their handles.

INCREMENTAL IMPROVEMENT

Software Publishing Corp. has made far less radical changes to the \$595 Harvard Graphics for DOS, Version 3.05, which should be available by the time you read this. Some of the improvements, such as full support for DOS 5.0 and faster menu redraws, are easy to overlook. Other enhancements, including the ability to import Lotus 1-2-3 3.0 and Excel 3.0 charts and data, are more readily apparent.

Perhaps the most dramatic enhancements, though, come in the form of the package's new ScreenShow capabilities. With Version 3.05, you can now launch any DOS or Windows application (such as an animation program) from within a Harvard ScreenShow, either automatically, or manually via a HyperShow button. ScreenShows are faster and more colorful, too, now that Harvard predraws charts in memory and supports VGA in ScreenShows.

Because of another welcome addition, you can now print all .PCX files used in a presentation for use as handouts—and on a wider variety of black and white and color printers, too. You can also record and play music and voice annotations as part of your ScreenShows. The package now supports both waveform and MIDI-files.

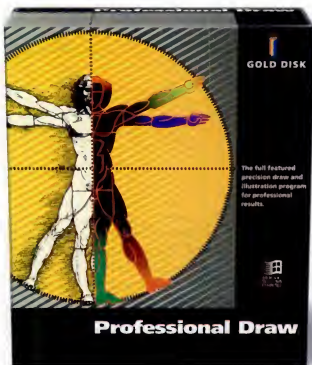
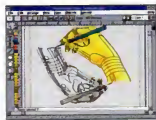
These upgrades may not change the face of presentation graphics, but they do prove that DOS is not dead. And contrary to that well-worn adage, you can definitely teach an old dog—or an old presentation graphics package—a few new tricks. □

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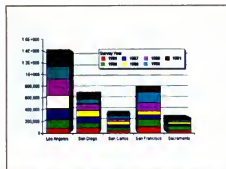
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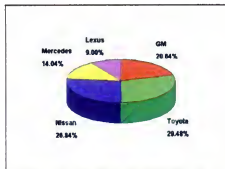
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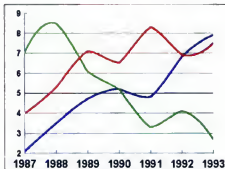
■ A Guide to Data Charting: *Breaking Out Beyond Bars*



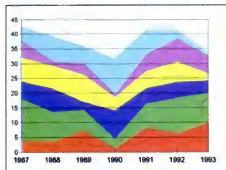
Column charts are useful for comparing discrete categories. For example, let's say you want to chart the number of participants by city in an ongoing survey. By representing each year as a different color, you can show the total and the break out by year while still keeping the display simple and attractive.



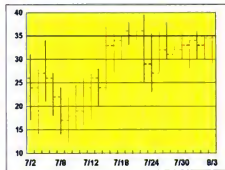
Pie charts are well suited for displaying relative proportions within a whole. In this example, the total number of cars sold is broken out by car type, with each type represented by a piece of the pie.



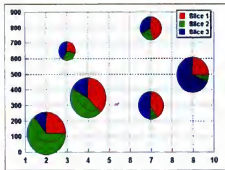
Everybody is familiar with the **line graph**. Today's charting tools provide options to smooth straight-line estimates into curves. Line charts are particularly useful in displaying trends (indicated by the slope of the line) over time. **Anchors**—lines running from the curve to the x- or y-axis—clarify exactly where a plotted point falls.



An **area plot** is useful for displaying the contribution of multiple items in making up a total over a continuous period of time. For example, you might track sales by product with each colored band representing a different product line.

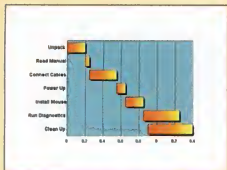


High-low-close charts are commonly used to convey information about stock prices over time; in general, they can also be used to display concisely a range of observations taken over several periods of time. The vertical bars can be used to indicate the high and low, while ticks on the left and right of the bar indicate the initial and final observations, respectively. Color coding can be used to emphasize either the trend or the first or last observations.

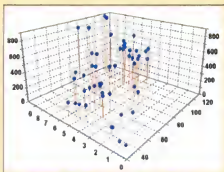


Bubble plots are effective for displaying certain types of multidimensional data sets; bubble size is a visually intuitive way to represent relative importance. Let's say you want to look at product sales (on the y-axis) by region (on the x-axis). The diameter of the bubble could indicate the size of the potential market. By making each bubble into a pie chart, an additional variable can be introduced without making the chart visually complicated. For example, each slice could represent a different income group within the market.

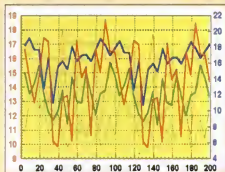
Bar and pie charts, long the staple of American businesspeople, are readily understood but not appropriate for many types of data. Today's presentation graphics packages can churn out more sophisticated data charts than ever before, so you might want to think of expanding your charting repertoire.—by Sheryl Canter



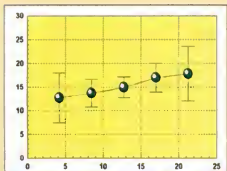
A complex project with many component tasks can be enormously difficult to manage without some device to keep track of what needs to be done and when. *Gantt charts* provide a visual representation of the start and end times of each task so you can immediately see where bottlenecks are likely to occur.



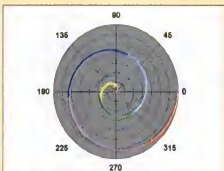
Scatter plots are an effective way to detect patterns visually in a data set. In regression analysis, a scatter plot of the errors is crucial for catching systematic patterns that would invalidate your results. The example shown includes *x,y* anchors, which make it easier to see the values associated with each point.



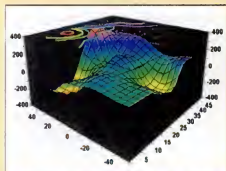
X,y plots with a double *y*-axis are useful for comparing the shapes of two curves that are scaled differently. For example, you could use an *x,y* plot to analyze seasonal sales patterns of two products with different sales volumes; the *x*-axis would be time, and each *y*-axis would be a product's sales. Similarities in seasonal patterns will be immediately apparent when the curves are plotted together on the same chart.



An *error plot* displays a measure of dispersion (the *standard deviation*) in addition to the mean, to give you a better sense of how well the average represents the data. Error-bar plots are commonly used to display the results of a regression analysis; an overlay of the *x,y* curve can be used to emphasize the trend.



The Cartesian (*x,y*) coordinate system is useful for many things, but it is not the only way to represent a point in space. Points can also be described in terms of a circle, rather than a rectangle; each point is located according to its distance from the center and its angle from a fixed radius within the circle. *Polar plots* are a more natural way than Cartesian plots to describe certain phenomena and are commonly used in star mapping and vector analysis.



Surface plots are useful for three-variable trend analysis. They provide a quick visual summary of complex relationships such as the combined effect on sales volume of dollars spent on television advertising and in-store promotion. Overlaying a color-coded contour plot can help make the information even clearer.

from having to edit the presentation manually, but those who favor the hands-on approach can edit at will. The chart title, legend, and individual data areas can all be selected separately, resized, and tagged with custom color and font specifications. The package can only generate graphs on two axes, though. To offset this, it does offer a cosmetic three-dimensional shading effect.

FACT FILE

Aldus Persuasion, Version 2.1
 Aldus Corp., 411 1st Ave. South, Seattle, WA 98104; 800-333-2538, 206-628-2320; fax, 206-343-4259

List price: \$495.

Requires: 286-based PC or better, 2MB RAM, 20MB hard disk space, Microsoft Windows 3.x

In short: Aldus Persuasion is tops for long, text-based presentations, and it includes powerful tools to customize individual slides. The weak data manager makes Persuasion less suited to intensive data charting.

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NO-FRILLS DATA HANDLING

On the other hand, Persuasion's Data Manager is adequate, but offers no extra frills. We had to import the spreadsheet for our test presentation by specifying a global cell range. The alternative is a tedious one-named-range-at-a-time procedure. Unlike its leading competitors, Persuasion will not let you select part of a data sheet to generate your graph: We had to cut and paste data manually to create a combination chart overlay in our test presentation. In addition, the overlay data must always be the first data series in the Data Manager.

Persuasion does support DDE and OLE links between Excel and 1-2-3 worksheets, allowing you to update your presentation automatically by changing cell data in another application. You can also link graphic images such as an Excel chart or a bitmap.

Persuasion's drawing tools are adequate, but the package offers only bit-mapped pattern fills—unsuited for use in 35-mm slides—and a limited number of line styles. Fortunately, we were able to substitute color fills for gray patterns

when creating our test flow chart, thereby avoiding the pattern fills. Persuasion offers a mediocre collection of black-and-white clip art, and only one color TIFF clip-art image. Excellent import filters compensate for the unimpressive clip art, making it possible to place vector and bit-mapped images from most PC and Macintosh drawing programs.

Persuasion is close to the top of the heap for displaying or printing finished slides. The flexibility offered by separate presentation and notes/handout printers allows you to prepare your output for a slide service bureau and accurately see what the handouts will look like at the same time. The generic Windows printer driver provided by MagiCorp Slide Service allows you to compose for 35-mm slide printing and still see WYSIWYG fonts on-screen. This driver, which supersedes the one included in the Persuasion box, can be downloaded from the MagiCorp BBS. It updates your ATM profile to map the MagicCorp font list to the fonts you have installed on your system.

The Notes feature allows only one slide per page, but in a pinch, you can fake multiple slides by configuring a handout page as a notes page. You can choose separate output devices for slides and handout/notes pages. This dual-selection feature is a thoughtful touch that ensures the presentation and handouts will print the way they look on-screen. The order of the slides in your presentation for display can be arranged at a glance in Persuasion's slide sorter.

For electronic presentations, 15 effects options can be applied to primary and subsequent slide layers. Persuasion supports successive layered builds, allowing any element to be positioned on any slide layer.

Whether electronic or slide-based, if you generate long, text-dominated presentations, Aldus Persuasion will meet—and probably exceed—your every need.

Claris Corp.

Claris Hollywood

BY LENNY BAILES

Claris Hollywood (\$499) includes many promising features, but the combination of an arcane interface and some program bugs may require you to put in extra time to get up and running. Most of the changes Claris has instituted in this formerly IBM-produced package are for the better: The company has added a variety of import filters for vector and bitmapped images, and text can now be added in either a slide or in the outliner. But there are still more improvements to be made.

When you open a new presentation, Hollywood starts you off on a blank slide page and assumes that you know what you are doing. Unfortunately, the template information and text stylesheets are hidden in the Color Schemes option in the fifth pull-down menu, so you'll have to do some digging before you can create a slide. Users in a hurry will probably

have to stick to the defaults in one of the predefined templates. These are fairly rudimentary, and the package doesn't provide options such as discontinuing the master background on individual slides.

Slide titles and bullet charts are updated automatically when changes are made in either outline or presentation view. Outliner contents can now be

displayed in 75, 50, or 25 percent reduced views, making it possible to work with WYSIWYG titles and chart text in large point sizes.

Hollywood's outliner does a satisfactory job of importing ASCII text or WordPerfect documents. You can set both font and color information in the outliner, simultaneously viewing your changes on a slide. The package's preconfigured stylesheets format title and text chart information automatically when it



Claris Hollywood's Data Manager allows you to import selected spreadsheet ranges into its worksheet and choose a display range by selecting with the mouse. Although you cannot select discontinuous ranges for graphing, you can save them to disk and subsequently reimport them in any order you like.

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1. Follow instructions on the other side

Back

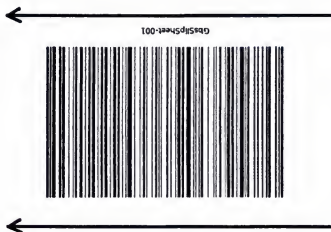
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Inverted Back

1. Follow instructions on the other side

Folded edge of the page



Inverted Foldout slip-sheet

Foldout slip-sheet



1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet





Bobby Billingsley - Senior Technical Representative

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- 14" Non-Interlaced 72Hz HRVGA
- Dual floppy drive
- 64KB Static RAM Cache on motherboard



Todd Reese - Sales Representative

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- Video accelerator built-in on motherboard

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- AMD 386DX processor rated at 40MHz
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is entered from the keyboard. Unfortunately, figuring out how to modify the default stylesheet settings is a time-consuming process. Users who are pressed for time will probably want to stick with the predefined style options. Our test presentation called for the placement of double-column chart text, which exceeded the outliner's capabilities. Although it was possible to create our chart as free-form text, this was a slow and cumbersome process. (Hollywood disables the use of the Tab key in a free-form text box.)

Bullet information for text charts is set from a Chart Options menu inside the outliner. Hollywood supports automatic bullets only with its six included Bitstream typefaces. An incompatibility with Windows 3.1 prevented Bitstream bullet characters and rotated text from

SUITABILITY TO TASK				
Claris Hollywood				
	POOR	FAIR	GOOD	EXCELLENT
Quick/inrequent presentations	●	●	○	○
Text charting	●	●	●	○
Data charting	●	●	○	○
Illustration and annotation	●	●	●	○
Desktop presentations	●	●	●	○
Hard-copy presentations	●	●	●	○
Presentation management	●	●	●	○

printing to a PostScript printer in our test presentation. Claris plans to release an update soon to correct this problem and make the package compatible with True-Type fonts.

Data charting is one of Hollywood's stronger features. Its Chart Gallery offers a variety of graphic chart design options. If you configure a format you like, you can paste it into the gallery as a template for future presentations. Hollywood's Data Manager is full-featured, allowing you to graph portions of a worksheet and link the presentation to Microsoft Excel or Lotus 1-2-3. Only two-dimensional graphing is supported, but you can set up multiple y-axes, reverse the axes, and specify the number and location of tick marks on the graph.

Cosmetic control of the chart's appearance on the slide is somewhat limited. The elements of the chart are fixed in relation to one another, and although

SUMMARY OF FEATURES

Presentation Graphics Software

All of the presentation graphics products we reviewed have certain capabilities in common; some of the most important ones are listed below. The table on the following pages is designed to highlight the distinctive attributes of the various packages.

What All the Products Have in Common

General Features

- Run under Windows.
- Allow you to have multiple graphs on-screen.
- Support the Windows Clipboard.
- Allow you to share network printers.
- Let you zoom in on chart elements.
- Allow you to cut, copy, and paste.

Text Charts

- Let you create bullet charts with user-defined bullets.
- Let you add free-form text labels.
- Automatically wrap text.
- Justify text.
- Support Adobe Type Manager, FaceLift, and True-Type.

Business Charts

- Offer semi-log and log-log scaling.
- Edit charts interactively (with varying degrees of flexibility).
- Import .WK1 files.
- Generate the following chart types:
 - Plain, stacked, overlapped, and clustered bar and column charts.
 - Projected and shadowed 3-D bar and column charts.
 - 2-D and 3-D pie charts.
 - Line and scatter plots.

- Area charts (unstacked, stacked area total, and stacked 100 percent area).
- High-low-open-close charts.

Color Handling

- Create horizontal, vertical, and angled gradient fills.

Annotation and Illustration

- Create lines, polylines, boxes, circles.
- Let you move an object to front and back.
- Resize objects.

Presentation Management

- Use either templates or masters or both.
- Support common slide backgrounds.
- Let you use templates from existing presentations.
- Store presentations in a single file.
- Create handouts.

Electronic Presentations

- Create screen shows.
- Offer standalone runtime players (DeltaGraph Professional, Microsoft PowerPoint, and Stanford Graphics require Windows, and SoftChart Presenter uses the Autodesk Animation Player).

Hard-Copy Presentations

- Allow you to print an individual slide or the entire presentation.
- Can print to a file.
- Support printing via Windows drivers.
- Include communications software for service bureaus.
- Support imaging of gradient backgrounds

Documentation and Support

- Provide on-line help and hard-copy documentation.

you may choose Top, Side, or Bottom for the legend and axes, you can't manually move them around or assign different fonts and color schemes.

STRONG DRAWING TOOLS

Hollywood has a better-than-average set of drawing tools: Features such as its three-color wash effect, variable text rotation, and special text fitted to a circle are not available in most competing packages. The diamond tool is useful for con-

structing makeshift flow charts, and the package supports editable Bezier curves. Users may design their own custom line styles and patterns, although symbols cannot be imported. The package includes a large number of full-color clip-art images and allows you to convert any imported vector file into an editable Hollywood object. Unfortunately, we were unable to import an EPS file produced by CorelDRAW for our test presentation, so we had to make do with a

► **S U M M A R Y O F F E A T U R E S**

Presentation Graphics Software

Products listed in alphabetical order

■ = YES □ = NO

	Aldus Persuasion	Claris Hollywood	DeltaGraph Professional	PC EDITOR'S CHOICE Freelance Graphics for Windows	Harvard Graphics for Windows	PC EDITOR'S CHOICE Microsoft PowerPoint	
List price	\$495	\$499	\$495	\$495	\$595	\$495	
General Features							
Total memory required	2MB	1.6MB	4MB	2MB	2MB	2MB	
Space needed for program files	10MB-13.5MB	4.8MB-8.2MB	7MB-22MB	5MB-11MB	10.5MB-18.5MB	5MB-17MB	
Maximum displayable colors (undithered, dithered)	256, 256	16, 256	Depends on graphics card	256, 256	256, 256	16.8 million, 16.8 million	
DDE and OLE support	Data, graphics (client)	Data (client)	Data, graphics (client); graphics (server)	Data (client)	Data (client)	Graphics, sound, video (client, server)	
Simultaneous open windows	□	■	■	■	■	■	
Text Charts							
Automatically create progressive builds	■	■	■ (in slide show)	□	□	■ (first-level bulleted items)	
Automatic multicolumn tables	■	■	■	■	■	□	
Adjust kerning/leading	■ ■	■ □	□ ■	□ □	■ ■	□ ■	
Align text on baseline	□	□	□	■	■	■	
Indent text	□	■	■	■	■	■	
Rotate text	■	■	■	■	□	■	
Set text margins	□	■	□	■	□	□	
Spell-checker	■	■	■	■	■	■	
Checks chart legends and annotations	■	□	■	■	■	□	
Font support:							
Number of typeface families supplied	4	3	4	4	5	7	
Vendor and format	Adobe, Type 1	Bitstream, Speedo	Adobe, Type 1	Adobe, Type 1	Bitstream, Speedo	Monotype, TrueType	
Bundled type scaler	Adobe Type Manager	None	Adobe Type Manager	Adobe Type Manager	None	None	
Restrictions on type formats supported	None	None	No support for printer-based fonts	None	No support for Intellifont- for-Windows or Super Print	None	
Business Charts							
Reusable chart styles	■	□	■	■	□	□	
True 3-D bar chart	□	□	■	□	□	■	
Pie charts:							
Yank and place slices	■	□	■	□	■	■	
Place at user-defined distance	■	■	□	■	■	■	
Multiple linked pies	□	■	■	■	■	□	
Proportional pies	□	■	■	□	■	□	
Cumulative area charts	■	■	■	■	■	■	
Combination charts:							
Line over bar/ over area	■ ■	■ □	■ ■	■ ■	■ ■	■ ■	
High-low over bar	■	□	■	□	□	■	
Maximum number of overlays	1	1	9,999	Unlimited	10	2	
Miscellaneous charts:							
Automatic organization charts	■	■	■	□	■	□	
Bubble	□	□	■	□	□	□	
Gantt	□	□	□	□	□	□	

N/A—Not applicable. The product does not have this feature.

Presentation Graphics

TIFF file instead. Hollywood's handling of vector and bitmapped images is limited to 256 colors.

The program also has its share of output problems. When sent to the Tektronix printer, our TIFF logo printed in reverse, although it did print correctly in the slides produced by the bundled MagiCorp Slide Service driver. Currently, Type 1 fonts (via Adobe Type Manager) are not explicitly supported.

Hollywood does have a serviceable slide sorter and offers a variety of transition effects. Presentations can be shown outside of Windows with an included runtime display module. Support for notes limits the user to one slide per page, and the handout feature must be tweaked manually on each individual page to be used in its stead. The package does satisfactorily convert color backgrounds to dithered black and white or gray scale, but if you want to print drafts without the background, you must manually toggle settings in the presentation.

Hollywood's included tutorial is rudimentary and the documentation is a bit out of date, but the package's templates and predefined text styles will allow an intelligent novice to produce a quick-and-dirty presentation without extensive reference to the program's more advanced options. For the user willing to absorb its higher learning curve and eccentricities, Claris Hollywood is capable of producing fine presentations. If the company resolves the output problems discussed here, Hollywood might become a presentation graphics contender.

SoftCrest Presenter	Stanford Graphics
\$595	\$495

2MB	2MB
2MB-3.6MB	6MB-3MB
16.8 million, 16.8 million	16.8 million, 16.8 million
Data (client, server)	Data (client, server); graphics (server)
☐	☒

	
	
 	 
	
	
	
	
	
	N/A
2	19
Bitstream, Speedo	Upgrade Systems, TrueType
None	None
None	No support for Symbol TrueType or WingDings fonts

	■	■
	■	■
	■	□
	■	■
	□	■
	□	■
	□	■
	□ □	■ ■
	□	■
	None	Unlimited
	■	□
	□	■
	□	■

CONTINUES

DeltaPoint Inc.

DeltaGraph Professional

BY ROCK MILLER

DeltaGraph Professional would seem to be just the ticket for technical users whose needs go unmet by traditional presentation graphics packages, which are geared to the average business user. Unfortunately, this \$495 package doesn't handle presentation-management jobs as well as it handles technical charting, and it proves a disappointment as an all-around solution.

Considering its origin—the graphical Macintosh environment—DeltaGraph's presentation metaphor is remarkably old-fashioned. Though its files hold entire presentations, the fundamental unit of operation is a single slide window, which can hold multiple text or data charts. You can apply a common background to any slide, and you can generate a series of text charts from an outline in the data worksheet, but there are no slide masters. Printing handouts, using the slide sorter, or giving a screen show requires that you create a separate list of slides and compile them into a set of thumbnails.

To be fair, DeltaGraph offers several ingenious features to help you create slides. The most impressive of these is its libraries, a really handy feature that lets you keep chart templates at the ready, visible as thumbnails in a small window. We used the libraries to good advantage to create word charts: Once we had styled the first chart to our liking, we simply dragged it into our library window as a template, and then dragged it out onto subsequent slides. (Alternatively, you can mark off the information first, and then select the library template you want to use.) You can use libraries to hold imported graphics and other slide elements; they also hold DeltaGraph's regrettably poor collection of clip-art images.

Fundamentally, though, this approach just doesn't do the job, especially when it comes to making changes on your slides. Updating text charts requires going back to the data worksheet, and global style updates—for instance, removing the underlines from our title text—require you to edit each and every

▶ FACT FILE

Claris Hollywood, Version 1.1

Claris Corp., 5201 Patrick Henry Dr., Santa Clara, CA 95052; 800-325-2747, 408-727-8227; fax, 408-987-7460



List price: \$499

Requires: 286-based PC or better, 2MB RAM, 8MB hard disk space, Microsoft Windows 3.x.

In short: Claris Hollywood has fine color capabilities and a passable text outliner, but an arcane

interface results in a package useful only for those willing to invest the time to learn its features.



ON READER SERVICE CARD

SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

Aldus
Persuasion

Claris
Hollywood

DeltaGraph
Professional

PC
EDITORS
CHOICE
Freelance
Graphics for
Windows

Harvard
Graphics for
Windows

PC
EDITORS
CHOICE
Microsoft
PowerPoint

Technical Charts

Technical graph types:						
Box plot	□	□	□	□	□	□
Contour plot	□	□	■	□	□	□
Histogram	□	□	■	□	□	□
Polar	□	□	■	□	□	□
Spider plot	□	□	■	□	□	□
Surface plot	□	□	■	□	□	□
Technical scaling options:						
Logarithmic in base 10/ natural logs	■ □	■ □	■ ■	■ □	□ ■	■ □
Multiple x-axes/y-axes	□ □	□ ■	■ ■	■ ■	□ ■	□ ■
Curve fitting:						
Linear regression	□	□	■	■	■	□
Polynomial/exponential	□ □	□ □	■ ■	■ ■	■ ■	□ □
Plot mathematical functions	□	□	■	□	■	□
Save curve data in file	□	□	■	■	□	□
Error bars	□	□	■	□	■	□
Calculate from data	N/A	N/A	■	N/A	■	N/A
Plus-or-minus range	N/A	N/A	■	N/A	□	N/A
Standard deviation	N/A	N/A	■	N/A	□	N/A
Data smoothing	□	□	■	□	□	□

Data Handling

Data import:						
ASCII:						
Comma-delimited	■	■	■	■	■	■
Fixed-field	□	□	□	□	□	□
Tab-delimited	■	□	■	■	□	■
DBF (dBASE)	■	□	■	■	□	□
DIF (Lotus)	□	□	■	□	□	□
SYLK	□	□	■	■	□	■
XLS 3.x/4.0 (Microsoft Excel)	■ □	■ □	■ ■	□ □	■ ■	■ ■
XQS (Quattro Pro)	□	□	■	□	□	□
Maximum data points per series	8,192	72	10,000	4,000	1,023	4,000
Total series in data sheet	256	72	Unlimited	26	31	255
Total points in data sheet	8,192	5,000	Unlimited	104,000	16,000	1,020,000
Import named ranges	■	□	■ (from Excel only)	■	■	■
Preserve named range in data sheet	■	■	□	■	■	■
Ignore blank rows and columns	□	□	□	■	■	■
Math functions in data sheet	□	□	■	□	■	□
Data transformation by function	□	□	■	□	■	□
Data linkage:						
Live link to external worksheet	■	■	■	■	■	□
Chart import:						
CHT (Harvard Graphics)	None	As vector graphic	As live chart	As live chart or vector graphic	As live chart or vector graphic	None
Lotus 1-2-3	None	None	None	As live chart, vector graphic, or bitmap	None	None

N/A—Not applicable. The product does not have this feature.

GRAPHICS

Presentation Graphics

SoftCraft
Presenter

Stanford
Graphics

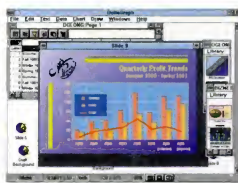


slide. And these conceptual problems are compounded by flaws in a thoughtless design. White or light-yellow text, for instance, is invisible on the white background of the text-editing box, and in our testing, text charts proved quite difficult to resize predictably without ruining the line spacing. And if you choose to use a custom page size for slides or overheads, you must apply it repeatedly to each new chart window.

Still, DeltaGraph's chief claim to fame is as a technical charting package, not as a presentation manager, and in this area it fares considerably better. It doesn't have the array of specialized technical charts that Stanford Graphics offers, but it covers the most common and important varieties and is easier to use, since it is operated by a few buttons in a single, multipage "data notebook," which holds text outlines as well as data spreadsheets.

The data notebook's multipage design makes it convenient for holding multiple data sets or transformations. Although you cannot link data pages together or exclude entire rows, you can easily cut and paste data and mark off contiguous or discontinuous blocks of data for charting. You can import data in a variety of formats, and although you cannot link your data pages directly to files on-disk, you can set up live links (via DDE or OLE) between the data notebook and other Windows applications. A formula builder lets you calculate the contents of any column: Its basic math, log, and trigonometric functions are supplemented by a few statistical operations and by functions to fill and filter your data.

Curve fitting is likewise straightforward. The program supports power and spline fits in addition to the ordinary linear, polynomial, and exponential varieties, and you can apply a different curve fit to any x,y series. The curve-fit equation can be copied to the Clipboard for pasting into slides (as a chart annotation) or into the formula builder or your



DeltaGraph Professional uses small library windows to hold chart templates and other presentation elements; creating and using templates is as simple as dragging thumbnails in and out.

spreadsheet to generate a data set. Data point symbols are based on dingbat fonts, so you'll never run out of options; the program comes with a proprietary symbol font to get you started.

A BUGGY HIDE

DeltaGraph supports OLE for both client and server

operations (client only for data), but this link worked poorly on our tests: DeltaGraph charts came in to other applications with clipping problems, and a bug prevented the link from being maintained once the other applications were closed. DeltaPoint is working on fixing this problem.

OLE problems aren't the only ones plaguing DeltaGraph. Fatal errors at irregular intervals were not uncommon during our testing experience, and redraws are often too slow to work comfortably. The screen show is so slow and unattractive that it is basically unusable. Some of the annotation tools—the Bezier curve and the eyedropper tools, for instance—work awkwardly or irregularly at best. You can't break apart clip art or imported pictures to recolor them, and although you can resize images, you can't flip them. And our initial test version failed to print line breaks correctly as shown on-screen.

DeltaGraph has its own routines for handling PostScript output. The reason, say its makers, is to get greater precision

SUITABILITY TO TASK

DeltaGraph Professional

	POOR	FAIR	GOOD	EXCELLENT
Quick/inrequent presentations	☐	☐	☐	☐
Text charting	☒	☐	☐	☐
Data charting	☒	☒	☒	☒
Illustration and annotation	☒	☒	☒	☐
Desktop presentations	☒	☐	☐	☐
Hard-copy presentations	☒	☒	☐	☐
Presentation management	☒	☒	☐	☐

CONTINUES

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7547	■ Adobe Type Manager 2.0 for Windows. 65.
6591	□ Adobe Illustrator 4.0 for Windows..... 389.
5988	□ Adobe Illustrator Competitive Upgrade. 189.
7940	□ Adobe Type Set Value Pack 1.0..... 39.
(Entire Adobe Type Library available.)	
Aldus	
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1332	□ PageMaker 4.0 for Windows..... 499.
6223	■ Gallery Effects 1.0 for Windows..... 139.
7540	□ IntelliDraw 1.0..... 199.
Alpha Software	
9724	□ Alpha FOUR 2.0 Competitive Upgrade (single user/standalone version)..... 99.
5104	■ Alpha FOUR 2.0 (incl. Free 2 LAN Pack) 329.
Altays Corporation	
8675	Fontographer for Windows (3 1/2" only).... 259.
Application Techniques	
8337	■ WinDings 1.0 for Windows..... 49.
1214	■ Pitzazz Plus 3.0..... 79.
Approach Software	
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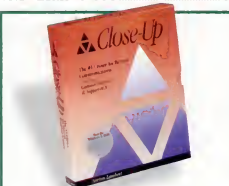
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4684	☐ Dvorak Top 30 (30 best shareware) 35.
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6456	☐ Isaac Asimov's Science Adventure 49.
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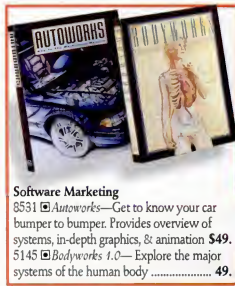
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3311	MasterStand.....	59.
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4518	101 Plus Keyboard.....	99.
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8630	Isobar Ultra 6 (diagnostic circuitry)	52.
9312	BC500 Power Backup	219.
6506	BC1250 LAN Power Backup	499.
6018	LC1200 (line conditioner)	159.
1528	PS8.0 (600VA online UPS)	559.
	Video 7 ... 7 years	
7362	WinVGA (includes 1 MB)	165.
9768	VRAM II VGA 1 MB	329.
	Zoom Telephonics ... 7 years	
1307	Intl. 2400 Baud w/9600 Baud Fax Modem	79.
1178	Ext. 2400 Baud w/9600 Baud Fax Modem	92.
1494	Ext. 9600V.32bis... 195, 3075 Intl.	195.
3574	Ext. 2400 Baud V.42/9600 Baud Fax	115.
3386	FaxModem AFC (2400 baud 96S/48R)	59.
4430	FaxModem AFX (2400 baud 96S/48R)	79.
4429	FaxModem V.32bis 14,400 baud (Intl.)	219.
4428	FaxModem V.32bis 14,400 baud (ext.)	259.
7921	Pocket FaxModem	87.



PC Connection ... 1 year

Bringing out the power of Windows or any number of applications by boosting your memory.

5510	1 MB x 9 SIMMs (80 ns)	\$45.
2497	4 MB x 9 SIMMs (80 ns)	139.
5746	1 MB Chips (80 ns, set of 9)	45.

DRIVES

Colorado Memory Systems ... 1 year

4194	Jumbo 120 Tape Backup	199.
4354	Jumbo 250 Tape Backup	269.
	Conner Peripherals ... 1 year	
2339	CP30104H 120 MB IDE HD (19 ms)	399.
1337	CP3204 200 MB IDE HD (16 ms)	539.
	IOmega ... 1 year	
	We are an authorized Iomega Service Center.	
6499	Portable 90 PRO	679.
6502	Insider 90 PRO 579, 6501 Dual 90 PRO 1479.	
6343	PC Powered 90 (incl. PC2B & cart.)	499.
6344	PC Powered 90 PRO (incl. PC2B, cartridge & Central Point Software)	599.
2500	PC2B 2-Controller	149.
2530	90 MB Cartridge	2467
8480	Tape250 Insider Tape Backup	439.
8481	Tape250 Insider Half-High Tape Bckp	259.
8482	Tape250 PC Powered Tape Backup	359.
	Mountain Network Solutions ... 2 years	
3152	FS8500 IDE Tape Backup (304 M)	499.
6183	DC2120 Tape Cartridge (5 pack)	149.
	NEC ... 2 years	
6577	CDR37 Portable CD-ROM Drive	399.
6582	CDR74 Portable CD-ROM Drive	589.
6581	CDR84 for PC/XT/AT	499.
7023	MPC Upgrade Kit (with CDR37)	949.
7021	MPC Upgrade Kit (with CDR84)	1079.

Pacific Rim ... 1 year

1304	1.2 MB External (for any parallel port)	\$239.
2761	1.44EX MB Ext. (for any parallel port) ..	239.
	Quantum ... 2 years	
8304	Plus Hardcard II XL 50 MB (9 ms)	225.
8287	Plus Hardcard II XL 105 MB (9 ms)	389.
	Summit Memory Systems ... 2 years	
6436	SE120 Tape Backup	215.
	TEAC ... 1 year	
6951	1.2 MB Drive for AT	65.
4670	1.44 MB Drive for PC/XT (3 1/2")	59.
4326	1.44 MB Drive for AT (3 1/2", w/Bastech) ..	75.
4414	3 1/2" 5 1/4" Dual Floppy Drive	145.

MEMORY

6556	256k DRAMs (100 ns, set of 9)	19.
5510	1 MB x 9 SIMMs (80 nanosecond)	45.
2497	4 MB x 9 SIMMs (80 nanosecond)	139.
5746	1 MB Chips (80 ns, set of 9)	45.



IOmega ... 1 year

6343	PC Powered 90—Lowest priced	
	Bemouli drive ever in one complete, convenient package. Includes 90 MB cartridge, PC2B interface card, and cable	\$499.
6344	PC Powered 90 PRO	599.



IOmega ... 1 year

Tape250—CIC & Irwin compatibility in one	
affordable tape drive! Stores 250M & includes	
data compression & Central Point Backup .	
8480 Tape250 Insider Tape Backup	\$239.
8481 Insider HH 259, 8482 PC Powered 359.	

DISKS/MEDIA

	Fuji ... lifetime	
2214	3 1/2" DS Disks (10)	9.
2215	3 1/2" HD Disks (10)	15.
2239	3 1/2" HD Color Disks (Qty. 10)	59.
2243	3 1/2" DS Color Disks (Qty. 10)	10.
	Sony ... lifetime	
3292	5 1/4" HD Disks (Qty. 10)	11.
3297	3 1/2" DS Disks (10)	9.
3298	3 1/2" HD Disks (10)	15.
8185	QD2040	14.
	1895 QD2120	21.

3M ... lifetime

3943	DC2000	\$17.
	1581 DC2120	\$22.
	Toshiba ... 2 years	
4858	3 1/2" 2.88 MB ED Disks (Qty. 5)	28.
9755	3 1/2" 2.88 MB ED Disks (Qty. 10)	53.

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- We accept VISA and MASTERCARD.
- No surcharge added for credit card orders.
- Your card is not charged until we ship.
- If we must ship a partial order, we never charge freight on the shipment(s) that complete the order (in the U.S.).
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- Upon receipt and approval, personal and company checks clear the same day for immediate shipment of your order.
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- COD max. \$1000. Cash or cashier's check.
- 120 day limited warranty on all products. Defective software replaced immediately. Defective hardware repaired or replaced at our discretion. All items subject to availability. Prices and promotions subject to change without notice.
- Our order lines are open continuously from 8:00 a.m. Monday until 5:00 p.m. Sunday Eastern Time. You can call our business offices at 603-446-3383 Monday through Friday 9:00 a.m. to 5:30 p.m. Eastern Time.



3M ... lifetime

1581	DC2120 Data Cartridge—w/ QIC 40	
	and QIC 80 compatible data cartridge.	
	Unformatted	\$22.

SHIPPING

Continental U.S.: The total freight charge on any order placed with PC Connection is only \$5. Barring events beyond our control, all credit card orders phoned in weekdays by 3:00 a.m. Eastern Time will ship Airborne Express for delivery the next business day. Which means same day delivery for orders placed between midnight and 3:00 a.m. Eastern Time. (Some orders may ship by UPS Ground for next day delivery). Saturday delivery available to many areas upon request at no additional charge. Order all day Saturday through noon on Sunday for Monday delivery. (Some areas require an additional day delivery).

Hawaii, Alaska, Canada, Puerto Rico and the U.S. Virgin Islands: Call 800-800-0004 for information on shipping and charges.

All other areas: Please call 603-446-0004 or FAX 603-446-7791 for information.

The frost is all over the proverbial pumpkin up here in Marlow, NH (pop. 601), and we're ready to hunker down for some serious snowfalls and toe-tingling temperatures. Meanwhile, our mascots have paused to give thanks for another year of successful nocturnal visits to our vegetable garden! Well, why not share the bounty? That's what we're doing with this smorgasbord of specials good through 11/30/92. No turkeys here!



Asymetric
1766 **MediaBlitz! 1.0**—Windows 3.1 multimedia utility for editing and synchronizing clips. Create shows in minutes and integrate them into other Windows applications with DDE. Over 70 clips free upon registration.
\$69



T E R M S

- Everything Overnight® \$5.
 - Weekend Shipping, too!
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 - One-Minute Mail Order™
- See complete terms on opposite page.



Adobe Systems
5988 **Adobe Illustrator 4.0 Competitive Upgrade**—Owners of draw and design programs can trade up to Illustrator 4.0. Includes TypeAlign, ATM, Separator, 40 fonts, pre-drawn artwork, and more.
\$189



Lotus
5799 **Ami Pro 3.0**—Includes new direct access features, including Fast Format, SmartIcon sets, Drag & Drop, and SmartClick. Get a free copy of *Intermission Screen Saver* (ends 11/30/92).
\$249



Intel ... 3 years
5990 **SatisFAXtion Modem 100**—Intel SatisFAXtion interface and compatibility at an unbeatable price. Internal 2400 bps data modem, 9600/4800 bps fax, bundled with a free copy of *Faxability Plus* (ends 11/30/92).
\$99



Alpha Software
5104 **Alpha Four 2.0 Server w/2 Free LAN Packs**—Fully relational database-management system for non-programmers. Create complex applications through menus. Uses dBase file format. Incl. *Presentation Express* and a *Zip Code Database* free (ends 11/30/92).
9724 **Alpha Four 2.0 Competitive Upgrade** (single/standalone version) \$99.
\$329

PC CONNECTION®

GRAPHICS
Presentation Graphics

► **S U M M A R Y O F F E A T U R E S**

Products listed in alphabetical order

■ = YES □ = NO

**Aldus
Persuasion**

**Claris
Hollywood**

**DeltaGraph
Professional**

**PC EDITORS
CHOICE**
**Freelance
Graphics for
Windows**

**Harvard
Graphics for
Windows**

**PC EDITORS
CHOICE**
**Microsoft
PowerPoint**

Data Handling (continued)

XLC (Excel)	As live chart or vector graphic	None	None	None	As bitmap	As live chart, vector graphic, or bitmap
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Chart Editing and Formatting

Edit text directly on chart	■	□	■	□	□	■
Scale chart to fit	□	■	□	■	■	■
Rotate chart	□	□	□	■	■	□
Chart options:						
Display grid	■	■	■	■	■	□
Multicolumn legends	□	□	■	□	■	■
Calculate and show percent	■	■	■	□	■	■
Fill patterns	Hatch, bitmap	Hatch, bitmap	Bitmap	Hatch	Hatch, bitmap	Hatch
Create/import fill patterns	□□	■□	□□	□□	■■	□□
Color handling:						
Preset color palettes	None	None	1	18	30	5,000
User-definable palettes	■	■	□	■	■	■
User can apply global color scheme	■	■	□	■	■	■
Number of colors in palette	200	256	16.8 million	256	32	16.8 million
Maximum colors per chart	200	256	231	26	64	16.8 million
Gradient fills:						
Objects/slide backgrounds	□■	■■	■□	■■	■■	■■
Radial fills	□	■	■	■	□	■

Annotation and Illustration

Text annotations	□	□	■	■	■	■
Shadowed box	N/A	N/A	■	□	■	■
Illustration tools:						
Arc	■	■	■	■	■	■
Curves	Bezier, spline	Spline	Bezier, freehand, spline	Bezier, freehand	Spline	Bezier, spline
Rounded box	□	■	■	■	■	□
Image manipulation tools:						
Align to baseline/to object	■■	■■	□■	■■	■■	■■
Break objects apart	■	■	■	■	□	■
Flip/Mirror objects	■□	■■	■□	■■	■□	■■
Group objects	■	■	□	□	■	□
Layers	■	■	■	■	■	■
Rotate objects	■	■	■	■	■	■
Any angle	□	■	□	■	■	□
Vector file formats (import/export):						
CGM (Computer Graphics Metafile)	■■	■■	■■	■■ (Freelance CGM only)	■■ (Harvard Graphics CGM only)	■□
.DRW (Micrografx)	■■	■■	■□	□□	■■	■□
.DXF (AutoCAD)	■■	■■	■□	□□	□□	■□
EPS (AI format)	□□	■■	■■	□□	□□	□□

N/A—Not applicable The product does not have this feature.

Presentation Graphics

FACT FILE

DeltaGraph Professional, Version 2.0

DeltaPoint Inc., 2 Harris Ct., Suite B-1,
Monterey, CA 93940; 800-367-4334,
408-648-4000; fax, 408-648-4020

List price: \$495.

Requires: 386-based PC or better, 4MB RAM, 7MB hard disk space, Microsoft Windows 3.x.

In short: DeltaGraph Professional does a decent job of basic technical charting, but its presentation facilities are relatively primitive by today's standards, and its design and quality problems take a lot of the shine off its abilities.

ON READER SERVICE CARD



(down to 1/26 of a point) and to improve the appearance of perspective labels. Unfortunately, there are many flaws with this approach; DeltaGraph's PostScript driver doesn't support TrueType, for instance (the program comes with Adobe Type Manager), and you must bypass it when going to slide output, which uses Autographix's own PostScript driver. And since the DeltaGraph PostScript setting failed to image the imported WMF logo on our title slide, we had to print our test presentation using the default Windows driver.

There is no setting to scale your images to a printer page or to center them. You must use PostScript's image-scaling facilities or live with the program's tendency to sever part of your image.

Despite these problems, DeltaGraph is a reasonable choice for technical charting. Just be warned: You are liable to be frustrated by its relatively inadequate presentation tools and design limitations.

Lotus Development Corp.

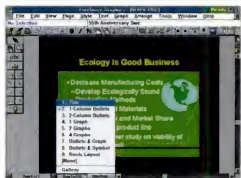
Freelance Graphics for Windows

BY ROBIN RASKIN

Less than one year old, \$495 Freelance Graphics for Windows is already yellowing a bit around the edges. While it remains one of the easiest presentation packages to use, age has revealed quite a few warts that have left us considerably less enchanted with Freelance than we

were when we last reviewed the package.

Freelance's Quickstart tutorial, use of SmartMasters (which provide a family of page layouts for each background type to let you create a uniform look easily throughout your presentation), and SmartIcon palette (a row of buttons that offer a quick route to many of the more common presentation tasks) are the hallmarks of the package. From the moment you load it, you are directed into treating a presentation as a whole: You design the common elements of a page using SmartMasters and then add content via the text outliner or in the slide view. For those users new to presentation graphics software, the program's omnipresent instructions—such as "Click here to enter text"—can mean the difference between a completed presentation and a nervous breakdown. A SmartMaster suite contains sequentially numbered pages that hold the template information corresponding to a particular style of slide: Basic Layout, Title Slide, 1-Column Bul-



All of the chart types you see listed in this pull-up menu are available in a similarly designed theme. Freelance Graphics for Windows refers to each set of page layouts for a given theme as a SmartMaster.

let Slide, and so forth. It is easy to switch between views—outline, current page, and page sorter—and the program's menu hierarchy is remarkably logical and up-front.

Freelance's well-rounded charting capabilities include scatter charts (with a variety of regression types), a selection of stacked bar types, 3-D graphs aplenty, and a table editor. You choose the graph styles from a visual display.

The package's drawing tools are of high quality, but they are not especially outstanding. You can draw Bezier curves and a suite of graphics primitives, but important touches such as shadowed text and boxes and thick lines are absent.

SoftCraft
Presenter

Stanford
Graphics

As vector graphic
(via Clipboard)

As vector graphic
(via Clipboard)



Hatch

Hatch, bitmap



8

1



(bullets and
annotations only)

16.8 million

16.8 million

16.8 million

16.8 million



Bezier, freehand,
spline

Bezier, spline



CONTINUES

► SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

**Aldus
Persuasion**

**Claris
Hollywood**

**DeltaGraph
Professional**

**PC EDITOR'S
CHOICE**
**Freelance
Graphics for
Windows**

**Harvard
Graphics for
Windows**

**PC EDITOR'S
CHOICE**
**Microsoft
PowerPoint**

Annotation and Illustration (continued)

EPS	■ ■	■ ■	■ ■ (export via Windows print driver)	□ ■	□ ■	■ ■
.PIC (Lotus)	■ ■	■ ■	□ □	■ ■	□ □	■ ■
.WMF (Windows metafile)	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
WPG (WordPerfect Graphics)	□ □	■ ■	□ □	□ □	■ ■	■ ■
Bitmap file formats (import/export):						
.BMP (DIB)	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
.CLP	□ □	■ ■	□ □	□ □	□ □	□ □
.GIF	□ □	■ ■	□ □	□ □	□ □	□ □
.IMG (GEM)	□ □	■ ■	□ □	□ □	□ □	□ □
.PCX	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
.TGA	□ □	□ □	□ □	□ □	□ □	□ □
TIFF	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Clip art:						
Number of images	101	184	380	500	500	573
Format	CGM	CGM, .WMF	Proprietary	Proprietary	Proprietary	Proprietary

Presentation Management

Multiple backgrounds per presentation	■	□	■	■	■	■
Can suppress background for individual slide	■	□	■	■	■	■
Uses slide templates	■	■	□	■	■	■
User-definable templates	■	■	N/A	■	■	■
Multiple templates per presentation	■	□	N/A	■	■	□
Presentation organization:						
Title sorter/Slide sorter	■ ■	□ ■	□ □	■ ■	■ ■	■ ■
Cut and paste slides to Clipboard	■	■	□	■	■	■
Outliner	■	■	□	■	■	■
Text file format (import):						
Ami Pro	■	□	□	□	□	□
DCA/RTT	■	■	□	□	□	□
Microsoft Word (DOS version)	■	□	□	□	□	□
RTF	■	□	□	□	□	■
Word for Windows	■	□	□	□	□	■
WordPerfect (DOS and Windows versions)	■	□	□	□	■ (Windows version)	□
WordStar	■	□	□	□	□	□
Speakers' notes	■	■	□	■ (slide thumbnails only)	□	■

Electronic Presentations

Transition effects	16	16	9	13	26	45
Overlay images	■	□	□	□	■	□
Sound-board support	None	None	None	Via DOS	Via MCI	Via MCI
Hyperlinks	□	□	□	□	■	□
Animation	□	□	□	□	□	□
MIDI and waveform file support	□	□	□	□	■	■
Autodesk FLI and MacroMind Director file support	□	□	□	□	■	□

N/A—Not applicable. The product does not have this feature.

Presentation Graphics

The Freelance clip-art collection, though not overwhelmingly large, is especially well implemented. You choose among the fully editable images from a visual preview library. Instead of wondering what an image called "Man1" might look like, using clip art becomes a science instead of a haphazard art. While a larger library would certainly be advantageous, we had no trouble finding ecologically appropriate symbols to use in our test presentation.

SIMPLE BUT INFLEXIBLE

There is, however, a price to pay for ease of use. Customizing the predefined

SmartMasters, which contain dotted-line demarcated placement blocks for text and graphics, as well as information about the background, fonts, and colors in your presentation, requires modifying the entire suite of master page layouts. Although the proficient user can devise some efficient workarounds, this is a tedious procedure, and one that is likely to introduce unexpected results.

For example, say you enter text in the Title placement block in the slide view, then decide that you would rather it be off-center than centered. If you simply move the text, the "Click here to enter text" message remains: Though the message won't print, it is rather disconcerting. And if you move the title block in SmartMaster view instead, it moves the corresponding block on every slide that uses that same layout. So you must either start every deviant layout from scratch using the Basic Layout template, settle for using the existing layouts, or spend a lot of time customizing them. In a nutshell, SmartMasters are terrifically easy to use—if you never want to change them.

Other less global problems can make your text-editing life miserable. Freelance relies on a pop-up text editor for editing text within a placement block. Freelance's outliner, though it uses a handsome notebook-like interface, doesn't really help you much with outlin-

ing. You cannot expand and contract levels of text, drag and drop to rearrange items, or get a WYSIWYG view of your text.

The program's built-in screen show is adequate, but not stellar. One of the best things about Freelance's showmanship is its ability to create a runtime version.

You can export your presentation to a single disk, executable from the DOS prompt, which is very handy for presenting on the road when you may not have access to a trustworthy Windows machine. But you can specify only a single duration between slides and the transition ef-

fects to use. The package provides no way for you to create a slide build other than to jerry-rig one.

Hard-copy presentations face other limitations, serious ones in some cases. You are limited to a few preset formats for notes and handouts and these are accessed, not as views, but as an option under the print menu: This means you can't even enter notes into the speakers' notes. In addition, the program clipped the output on a PostScript printer; we lost the

SUITABILITY TO TASK

Freelance Graphics for Windows

	POOR	FAIR	GOOD	EXCELLENT
Quick/inexpensive presentations	●	●	●	●
Text charting	●	●	●	○
Data charting	●	●	●	○
Illustration and annotation	●	●	●	○
Desktop presentations	●	●	●	○
Hard-copy presentations	●	●	○	○
Presentation management	●	●	●	○

SoftCraft
Presenter

Stanford
Graphics

■ ■
(export via
Windows print
driver)

□ ■

□ □

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Via MCI

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CONTINUES



FACT FILE

Freelance Graphics for Windows, Release 1.0

Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 800-343-5414, 617-577-8500; fax, 617-693-4551

List price: \$495.

Requires: 286-based PC or better; 2MB RAM (4MB recommended); 11MB hard disk space; Microsoft Windows 3.x.

In short: With a balance of features that is right on the mark,

Freelance Graphics for Windows remains one of the easiest, most comfortable packages for creating presentations quickly. Some of its biggest drawbacks are difficulty modifying the SmartMaster and an outliner that barely meets the definition of the word.

 486 CPU READER SERVICE CARD

GRAPHICS
Presentation Graphics

► **S U M M A R Y O F F E A T U R E S**

Products listed in alphabetical order

■ = YES □ = NO

**Aldus
Persuasion**

**Claris
Hollywood**

**DeltaGraph
Professional**

**PC EDITOR'S
CHOICE**
**Freelance
Graphics for
Windows**

**Harvard
Graphics for
Windows**

**PC EDITOR'S
CHOICE**
**Microsoft
PowerPoint**

Hard-Copy Presentations

Print options:						
Maximum number of slides per page	12	6	6	8	6	6
Background printing	■	■	■	□	■	■
Suppress background for printing	■	□	□	■	■	■
Color-to-monochrome printing:						
Colors convert to gray scales	■	□	■	■	■	■
Colors convert to pattern fills	□	■	■	■	□	□
Invert text and background colors	□	□	□	■	■	□
Monochrome color scheme	■	■	□	■	■	■
Film recorders:						
Agfa (SCODL)	■	■	■ *	■ *	■	■ *
Lasergraphics	□	□	■ *	■ *	■	■ *
Polaroid Palette	□	□	■ *	■ *	■	■ *
PTI Montage	□	□	■ *	■ *	□	■ *
Slide services:						
Custom slide service link	Autographix, MagiCorp	MagiCorp	Autographix	Autographix	Autographix	Geniographics
Pattern fills to colors or gradients	■	■	□	■	■	■

Documentation and Support

Tutorial (on-line/paper)	□ ■	□ ■	□ □	■ ■	■ ■	□ ■
Free technical support (eastern time)	10:00-8:00 M-F	11:00-8:00 M-Th; 11:00-5:00 F	9:00 A.M.-9:00 P.M. M-F	8:30-8:00 M-F	1:00-7:00 P.M. M-F	9:00 A.M.-9:00 P.M. M-F
BBS	CompuServe; company-run	None	CompuServe	CompuServe	CompuServe	CompuServe

* Via Windows drivers.

leftmost portion of our test logo on every slide. Correcting the problem meant manually rescaling the image to fit.

On a more basic level, this pre-Windows 3.1 product does not take advantage of OLE, still uses Adobe Type Manager (and ships with an outdated version), and uses some nonstandard Windows dialogs. A new version of the program, due out by the end of the year, promises across-the-board improvements, most of which should remedy our complaints. These include improvements in the outliner, screenshow capabilities (which will include builds, branching, and multimedia support), interapplication connectivity (including OLE and more import/export filters), and SmartMaster intelligence.

While you're waiting, you won't suffer by using the existing version. As a matter of fact, it reinforces all your bad habits about presentations. Since you can usu-

ally trust Freelance Graphics for Windows, you can leave your presentation preparation for the last moment and know you'll be fine.

Software Publishing Corp.

Harvard Graphics for Windows

BY ANGELA GUNN

Harvard Graphics for Windows entered the presentation graphics market well after the market-leading DOS version. And with its emphasis on ease of use, Software Publishing Corp.'s \$395 fledgling package is itself a great package for fledglings. Inexperienced or occasional users will be able to pull together handsome presentations easily. Graphics veterans, however, will find Harvard still comparatively rough in the charting and text-manipulation departments.

The interface is well designed for

quick start-up, with both text and on-line tutorials. (The on-line tutorial shipped as of this writing: If you don't have it, you can get the tutorial, free of charge, from SPC.) One-click switching among the outliner, slide sorter, and slide editor lets you refocus your artistic attention as necessary. The predesigned templates are attractive, and they load with matching palettes. The good-looking clip art was a joy: The 500 images are neatly organized in files in their own pop-up utility, accessible by icon.

The text-manipulation structure—a numbered outline—is easy to understand, but getting everything in place isn't as simple as it should be. Harvard easily imported our ASCII text into the outliner but tried to put everything on one slide; even after the sections were broken apart into separate slides, the package still held a Master slide with all our topics listed. The slide sorter showed the master link-

Presentation Graphics

each—provided a wide selection of attractive design options.

Creating our two-column progressive-build charts manually was far from difficult: We broke apart the text and manually introduced the graying, paying special attention to the bullets, which had to be formatted separately. But no facility exists for automatically creating them.

Amenities such as adjustable align-to-object capabilities were useful for positioning the columns of our bullet charts. However, text-fitting abilities would have also been useful, especially during the creation of our flow chart. If our test presentation had been slightly different, we could have made use of the organization chart templates, which automatically data such as the average corporate structure.

You can either type or import data into the package's data sheet, although any value that is the product of a formula will import as a string. Given SPC's claim of having pioneered automatic spreadsheet-presentation linkage, it's ironic that we ran into so many glitches. For instance, we had difficulty breaking links—the package does not allow linked data to be altered in any but its native spreadsheet—and masking out unnecessary data.

Harvard's charting capabilities stand firmly in the business realm, with a solid selection of basic charts. Its ability to reorient and stagger the x-axis labels certainly improved their readability over the crammed-together default arrangement, and chart elements such as the legend are easily moved and manipulated.

OBJECT DRILLS

Harvard's "drill-down" access makes changing elements of completed slides wonderfully easy. Repeatedly clicking on a desired component selects the largest group that the object is a part of, first, and then successively smaller groups until



The nondesigner will benefit from Harvard Graphics for Windows' preselected palette choices. The numbered colors correspond to specific portions of the chosen template.

you reach the desired level.

Shuffling views in the slide sorter is simply a matter of dragging and dropping; transitions are added through a separate menu. For more presentation flexibility, Harvard allows designers to define any object or text as a hyperlink key, which can move a presentation to another slide or to a Windows or DOS application. Hyperlink instructions may also be assigned to any number of keys on the keyboard. And Harvard can further dazzle your spectators with sound and animation clips that can be launched as MCI applications on any Windows setup supporting Multimedia Extensions.

With its merely adequate charting abilities and annoying text-handling quirks, Harvard Graphics for Windows is not the most technically dazzling package we review, but it is virtually idiot-proof. It supplies enough attractive templates, palettes, charts, and clip art to guide the fearful safely through the creative process. Supremely flexible object handling ensures that braver users will be able to implement many good ideas easily.

FACT FILE

Harvard Graphics for Windows, Version 1.01

Software Publishing Corp., 3165 Kifer Rd., Santa Clara, CA 95051; 800-624-6772, 408-988-7518; fax, 408-450-7915

List price: \$995.

Requires: 286-based PC or better, 2MB RAM (4MB recommended), 7MB hard disk space, Microsoft Windows 3.x

In short: Harvard Graphics for Windows, scion of the powerhouse DOS package, makes presentation development easy and fun for the novice user. Features such as charting, animation, and text manipulation are not top-flight but will doubtless improve as this package matures.

ON-READER SERVICE CARD

SoftCraft
Presenter

Stanford
Graphics

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CompuServe

CompuServe

ENDS

ing all the outline-based files; until we killed the master, we could not resort any of the slides to which it referred. The outliner handled text with drag-and-drop ease, making manipulation ridiculously effortless. Meanwhile, the title styles—one each for bulleted and title slides, with a decent collection of templates for

SUITABILITY TO TASK

Harvard Graphics for Windows

	POOR	FAIR	GOOD	EXCELLENT
Quick/frequent presentations	●	●	●	○
Text charting	●	●	●	○
Data charting	●	●	○	○
Illustration and annotation	●	●	●	○
Desktop presentations	●	●	●	●
Hard-copy presentations	●	●	○	○
Presentation management	●	●	●	●

Presentation Graphics

Microsoft Corp.

Microsoft PowerPoint

BY ROCK MILLER

The addition of a well-designed outliner, a standalone screen show, more drawing tools, and a greatly improved charting module have rendered Microsoft PowerPoint a much stronger competitor than earlier versions have been. Its fundamental strength, however, remains the same: This \$495 program is, hands down, the easiest, quickest, and most straightforward presentation package you can buy.



Microsoft PowerPoint's slide sorter is cleverly used to build on-screen presentations as well as to reorder slides. The program supports animated progressive builds and gives you an amusing preview of transition effects.

PowerPoint's lucid interface stresses flexibility and ease of use over raw power. As with previous versions, 3.0 lets you work on your presentation in any of several live views; changes appear instantly in all of them. Handy toolbars at top and bottom make it easy for you to switch between views, zoom in and out, and perform various editing functions in a few simple steps. The short tutorial in the manual, which takes no more than 45 minutes to complete, is more than sufficient to help you understand the basics of the program; the exceptionally well-written help system and manual make it easy to learn the rest as you go along. The 160 supplied masters are simple but attractive, and the ability to apply color schemes separately gives you a good variety of moods to choose from (the schemes have preselected accent and chart colors designed to harmonize with your background and text colors).

Microsoft remains unseduced by the multiple-master concept favored by

many of its competitors: PowerPoint's single presentation master incorporates only title, background, and word chart blocks. In practice, however, this is not a notable handicap, because thoughtful tools and design aids help you maintain consistency while giving you the freedom to roam. The useful Style Dropper tool, for instance, lets you apply the style of any object or text block to one or more selected elements; we used it to gray out the entries on our two-column progressive build slides. Similarly, draggable guide rules (with numeric measurement attached) make it relatively easy to align elements precisely.

A subtle but important advantage is the refinement with which PowerPoint handles exceptions to the rule. Any exceptions you make to a master element—for instance, changing the title style to signify a change in section on a given slide—are retained when you select a new master. If you change your mind, however, you can reapply the master with a single command. Deleting and restoring master text blocks is similarly easy. PowerPoint's eight-slab color schemes give enough accent colors for most purposes, yet are restricted enough to make global color changes work well; a handy function lets you globally substitute fonts as well.

POWER TEXT

PowerPoint's flexible text handling is perhaps its most impressive feature. Though the text chart master and outliner support only single-column bullet charts, you can place as many word-wrapped, indented, or otherwise styled text elements as you want anywhere on the slide. You can add word-wrapped text to any closed shape (PowerPoint offers a large palette of useful shapes) simply by double-clicking on it and typing; this feature was an enormous time-saver on our flowchart slide.

You can set text, line, and bullet attributes easily on a line-by-line, paragraph-by-paragraph, or global basis, and a handy font change button lets you shrink or grow text of mixed point sizes. The easy-to-use tab ruler goes far to make up for the product's lack of a table editor, at least for simple tables such as the one in our test slide.

By comparison, the program's data charting, though vastly improved, fails to

SUITABILITY TO TASK				
Microsoft PowerPoint				
	POOR	FAIR	GOOD	EXCELLENT
Quick/frequent presentations	●	●	●	●
Text charting	●	●	●	○
Data charting	●	●	○	○
Illustration and annotation	●	●	●	●
Desktop presentations	●	●	●	●
Hard-copy presentations	●	●	●	●
Presentation management	●	●	●	●

shine. True, it now offers a full array of 2-D and 3-D business charts and enough options to satisfy most, but its implementation—via an OLE server application called Graph, the same one shared by all Microsoft applications—still suffers from the handicap of all embedded objects. Editing charts is necessarily an arms-length operation; to move an annotation or adjust a label, you must double-click to open the chart, make the adjustment, return to see the effects in the context of your slide, and so on, which rapidly becomes tedious.

Moreover, Graph's layout capabilities are not as flexible as you would wish. When editing the pie chart, the legend had an annoying tendency to snap around

Microsoft PowerPoint, Version 3.0

Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400, 206-882-8080; fax, 206-936-7329

List price: \$495.
Requires: 286-based PC or better, 2MB RAM (4MB recommended), 5MB hard disk space (17MB recommended), DOS 3.1 or later, Microsoft Windows 3.1.
In short: Though less powerful than its competitors in some respects, Microsoft PowerPoint's hard-to-match ease of use and trouble-free design make it the best choice for most business presenters. Version 3.0 is greatly strengthened over previous versions, with the addition of an outliner, improved data charting, OLE client and server support, and a host of other enhancements.

ON READER SERVICE CARD

Presentation Graphics

when we tried to move it, and placing annotations proved downright awkward. In the end, it was easier to place them on top of the embedded image, using PowerPoint's basic but adequate drawing tools. Worst of all, you can't link on-disk worksheets or OLE-supporting data servers to the data window, so the only way you can get linked spreadsheet data into your presentation is to embed an Excel or other chart—not a satisfactory solution.

All things considered, however, PowerPoint is as smooth and polished at giving presentations as it is at creating them. Though its new screen show module requires Windows in order to run, it works quickly and well, particularly on 256-color screens (PowerPoint manages your VGA palette so you see only smooth gradients and pure colors, with

Gray-scale renditions look fine, however, and for complete reliability you can always apply a monochrome color scheme to the presentation.

PowerPoint is a fine presentation package that manages to be at once simple and sophisticated. Though graphic arts professionals will eschew it for its deliberate limitations, business users who are more interested in time-saving than in fancy presentation designs will find it fits their mandate to perfection.

SoftCraft Inc.

SoftCraft Presenter

BY ROCK MILLER

Injecting multimedia into the straightforward environment demanded by business presenters can be quite a challenge, but SoftCraft Presenter (\$595) proves that it is possible to do a reasonably good job of it. Making good use of animated objects and Windows sound and movie support to add some extra touches to screen shows, it nevertheless remains a solid if somewhat unrefined tool for creating simple hard-copy presentations.

Among the packages reviewed here, Presenter offers the most tools to lend motion and interactivity to your presentations. In addition to animating the charts themselves—making bars gradually grow to size, for instance—you can also create simple animated annotations or embed spiritlike objects for emphasis.

Presenter's support for bidirectional DDE (Dynamic Data Exchange) connections also opens up some interesting possibilities for data-driven animation—cycling through the effects of a change in interest rates, for ex-



SoftCraft Presenter's DataPictures can be thought of as intelligent clip art that allows the program to animate your data charts.

ample. You can make any object, including intelligent buttons, into hyperlink buttons.

Screen shows can be run from within the program for proofing purposes, but for acceptable display performance you really need to export them as .FL? files for playback using Autodesk's animation player, which is bundled with the package. Though this process proved very time-consuming—it took 17 minutes to export our eight slides on our test-bed—

Business users who are more interested in time-saving than in fancy presentation designs will find PowerPoint fits their mandate to perfection.

nary a dither). Setting up a screen show couldn't be easier: You simply select one or more slides and attach transition effects (there's an amusing animated preview). You can apply animated progressive builds to text chart slides (though only for top-level bullets) and the viewer takes advantage of Windows 3.1's improved OLE embedding abilities to let you place sound and even video buttons in your live screen shows.

The program accomplishes the rare feat of making hard-copy presentations almost completely trouble-free. There's a check box to set the aspect ratio for slides or overheads, and another check box in printing lets you shrink these automatically on output to fit on your printer page—never a cropped or distorted proof. Black-and-white conversion is less straightforward; you can set print options to convert the presentation to black and white or to remove the background, but these don't work perfectly on all printers.

We didn't start the PC price war.

(We'd never back down on quality.)

Presentation Graphics

SUITABILITY TO TASK

SoftCraft Presenter

	POOR	FAIR	GOOD	EXCELLENT
Quick/frequent presentations	●	●	●	○
Text charting	●	●	●	○
Data charting	●	●	○	○
Illustration and annotation	●	●	●	○
Desktop presentations	●	●	●	●
Hard-copy presentations	●	●	●	●
Presentation management	●	●	●	○

this rather intelligent scheme gives you a surprising and welcome amount of flexibility. The resulting screen shows perform well, with smooth gradients and transitions.

A system of overlays lets you display portions of a single image in sequence. This not only lets you reveal portions of a single slide in sequence, but also gives you better control of musical accompaniment than you'll typically find. Attached sounds (.WAV or .MID files) don't start

playing until the object to which the are attached appears. Embedding animations is equally straightforward: Just import your Animator .FL? files and place them on an overlay.

BACK TO BASICS

Presenter's interface, with outliner, slide sorter, and speakers' note views, is cleanly designed, and puts most of the tools you need within easy reach. The product comes with 11 mostly simple but decent-looking masters, to which you can apply 8 predefined color schemes for quick presentations. And though there is no clip art per se, you can animate charts or add other animated elements to your slides by using one or more of a selection of predefined intelligent DataPictures. (The DataPictures can respond to changes in data by increasing or decreasing in size.) Reasonably quick redraws make it suitable for use on less-powerful machines, though the program seemed to bog down quickly once we had created more than a few slides.

Creating your own master designs is

FACT FILE

SoftCraft Presenter,
Version 1.03

SoftCraft Inc., 16 N. Carroll St., #500,
Madison, WI 53703; 800-351-0500, 608-257-
3300; fax, 608-257-6733

List price: \$595

Requires: 286-based PC or better,
2MB RAM, 2MB hard disk
space, Microsoft Windows 3.x

In short: This simple, nicely implemented presentation package
is notable for its animation and

sound support, though it is not without some rough
edges.

ON READER SERVICE CARD



equally straightforward, though the fact that they are not linked (they don't even share a common background) required us to put in a bit of extra work to create all the masters. The well-designed palette handling makes it easy to customize color schemes, and you'll find the drawing tools (including Bezier curves) to be adequate. Presenter smoothly handles bulleted text and other word chart attributes, and you can even create and save text styles to help you keep labels and other freehand text elements consistent with one another.

The product's data charting must be rated as no more than adequate. True, you'll find most of the common business charts within an easy-to-use gallery. But there are no bar-line or other combination charts, nor does Presenter support chart overlays or multiple axes. We could not adjust the three-dimensional pie depth nor display pie percentages as labels on our Quarterly Profits chart. Various glitches made legend and labels a chore to get right, and the size of the chart bounding boxes, which are far larger than the chart body, made them awkward to manipulate.

All of the charts in a presentation are based on a single-page data sheet, which can accept any number of warm-linked (via import) or paste-linked (via DDE) spreadsheet or database files. You can perform basic math operations (including cumulative counts and ratios) or sort data by row or column, but you can't plot discontinuous ranges. All chart attributes

We didn't start the PC price war.

(Price isn't everything.)

Presentation Graphics

are set in a single, very large dialog box (with multiple buttons); this offers the advantage of allowing you to set all options at once before redrawing the graph, but makes for considerable difficulty when it comes to finding the options you want to set.

WORMS IN THE BUD

Unfortunately, omissions and rough edges take some of the luster off the program's abilities. The predefined DataPictures work well, but modifying them or creating your own requires you to recode their specifications in SCGL, the parametric language on which Presenter is based. (This advanced architecture, incidentally, makes it possible to generate custom charts or even entire presentations from external programs, by writing new parameters and data directly into the presentation file.) Animated an-

notations, produced by a crude tweening process, proved easy to set in motion but required a good deal of tinkering to get right. Unlike attached sound or music files, we could not get embedded .FL? files to repeat continuously. And the DDE-based external animations proved unreliable in our testing due to problems updating the DDE links.

Fortunately, the program handles ordinary hard-copy output with aplomb. There are separate settings for screen, slide, and paper aspect ratios, and unlike many packages, rescaling your presentation when moving from one to another isn't an act of faith; a dialog box clearly lays out all the options, from centering the image to rescaling or redistributing its elements. You have a wide variety of printing options, including 2-, 3-, 4-, or 6-

slide handouts plus notes and small thumbnails. A bug in the Scale to Page option caused some image clipping, but we were able to work around this easily by setting the percentage manually.

SoftCraft Presenter shows the seams you would expect in a first-time product (including rather poor documentation), but its basic presentation engine is sound and obviously well thought out. Though its nominal list price of \$595 is far too high for such a product, the package is worth your consideration at its introductory price of \$295.

3-D Visions

Stanford Graphics

BY ROCK MILLER

Stanford Graphics starts out with an inside track to the hearts of technical professionals. Descended from our Editors' Choice-winning Graftool (reviewed in "Picturing Your Numbers: 12 Technical Graphics Packages," March 26, 1991), this \$495 Windows program aims to com-

SoftCraft Presenter shows the seams you would expect in a first-time product, but its basic presentation engine is sound and well thought out.

We didn't start the PC price war.

(This is where we draw the line.)

Now we've the shot



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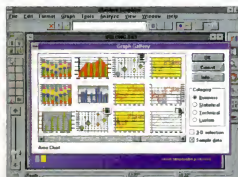
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**HEWLETT
PACKARD**

Presentation Graphics



Stanford Graphics produces a huge range of technical and business charts, visible in thumbnails within a colorful chart gallery. You can save your own designs here as well.

bine powerful technical plotting and analysis tools with the full panoply of modern presentation aids. Its array of high-concept technical charts, particularly statistical and engineering-oriented charts, is unmatched by any program in its class. Sadly, however, its mighty potential is almost completely destroyed by slovenly implementation and disappointingly poor quality.

With multiple masters, an outliner, a

slide sorter, handouts, and speakers' notes, Stanford Graphics attempts to compete with the best of the business presentation packages on their own turf. But the implementation of these features is so flawed that they often hinder rather than help. The master system is far from lucid; each of the nine separate masters is independent except for a common background (which cannot be overridden except by covering it up), and setting up bulleted text styles involves wading through complicated dialog boxes. Thus, you can bypass this effort by using one of the predefined sample masters, but these are of such poor aesthetic quality (as are the unprofessional-looking custom TrueType fonts) that you'll find yourself designing your own anyway.

Numerous interface glitches merely increase one's frustration. When we created a title placeholder, for instance, we found that the right-justified text constantly went past the right edge of the box; apparently, it does this if the text you type is larger than the 6-inch default that the program uses for the placeholder.

And much to our surprise, the graph placeholder doesn't enforce axis or label styles (although it does preserve the font settings), so all our efforts in this direction went for absolutely naught. Exceptions to the masters appear to work, but you will find that the master will reassert itself without warning unless you take the precaution of uncoupling it from the slide, which, of course, defeats the purpose.

The handling of output is equally ill-

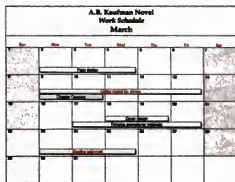
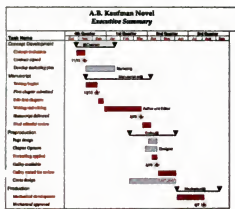
SUITABILITY TO TASK

Stanford Graphics

	POOR	FAIR	GOOD	EXCELLENT
Quick/inrequent presentations	●	●	○	○
Text charting	●	●	○	○
Data charting	●	●	●	○
Illustration and annotation	●	●	○	○
Desktop presentations	●	○	○	○
Hard-copy presentations	●	○	○	○
Presentation management	●	●	●	○

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Now you can enter and view data in a variety of ways—Gantt, tables, graphs, forms and more. Microsoft Project also has a customizable Toolbar, giving you access

Presentation Graphics

digested. There is no easy way to set the slide aspect ratio independently of the printer; if you set up your presentation using the MagiCorp slide driver, and then shift to a printer for proofing, parts of your images will be cut off unless you reformat them manually or, if you are proofing to PostScript, reduce the scale of the image to fit on the page. Printing is both slow and highly inefficient—it produced nearly 10MB of PostScript code from our basic 12-slide test presentation!—and our attempt to print our complex surface chart resulted only in a PostScript error. The results from the screen show facility are almost comical; the image was jammed into the upper left of the screen and compressed vertically, resulting in squashed, jaggy text and elliptical pie charts.

FATAL FLAWS

Such problems might be tolerable if Stanford Graphics did a spectacular job of technical charting, but its high talents in this area are irretrievably damaged by some of the same problems that afflict the rest of the program.

Stanford's data handling and analysis are ambitious.

You can open an unlimited number of spreadsheets, any or all of them linked to spreadsheets on-disk.

Its chart gallery (to which you can easily add your own custom-styled charts) shows thumbnails of just about every type of technical chart imaginable: two- and three-dimensional line, scatter, and bubble plots, contour and surface plots in wireframe and color-filled varieties, box-whisker plots, histograms, Pareto charts. The list goes on and on: Among the many exotic plots that can be found here but nowhere else are Smith charts, vector plots, group maps, and spectral plots. A unique "color-map feature" allows you to add

FACT FILE

Stanford Graphics, Version 2.0

3-D Visions, 2780 Skypark Dr., Torrance, CA 90505; 800-729-4723, 310-325-1339; fax, 310-325-1515

List price: \$495

Requires: 386-based PC or better, 2MB RAM (4MB recommended), 6MB hard disk space, Microsoft Windows 3.x

In short: This powerful and ambitious program offers an array of technical charting functions you won't find in other presentation packages, but design eccentricities and bugs prevent Stanford Graphics from living up to its potential

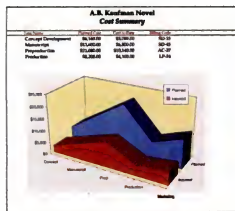


ON READER SERVICE CARD

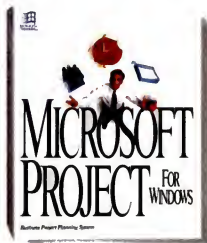
yet another dimension to your charts by means of data-controlled color shading. Doubtless, the results are enormously impressive.

Stanford's data handling and analysis capabilities are equally ambitious. You

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Microsoft
Making it easier

can open an unlimited number of spreadsheets, any or all of them linked to spreadsheets on-disk (you can't import database files). The powerful formula builder works like a spreadsheet, with formulas assigned to cells, not just columns, and its array of statistical and mathematical analysis functions is far richer than most spreadsheets. Graphical analysis functions, too, go far beyond the usual simple curve fits to embrace cyclical and geometric fits, interpolation, statistical tests, and fast-fourier transformations. The results of these analyses end up in multiple spreadsheets, where they can be further manipulated or exported in tab-delimited ASCII format.

Getting results, however, can be a chore. Each graph has a "range specifier" within the spreadsheet that lets you mark

off the data series, labels, legend text, and so on. This has the advantage of spelling out exactly which elements go into each chart, but it also means that you can't mark off data in the spreadsheet and then plot it; you must get out of your data window, select the graph type, and only then mark off data.

Once a chart is created, you can't change its type. This is made worse by the fact that some chart attributes are treated as separate chart types; if you decide to add error bars to your line chart, for instance, you must erase and re-create your chart.

These are eccentricities that one can live with, but the strongest criticism must be made about Stanford Graphic's poor standard of quality control. The version we tested—it had just begun shipping—was literally riddled with bugs. We traced

two chronic, fatal errors that almost prevented us from testing to interactions with the MagiCorp driver; we lost two presentations to one particularly nasty bug that trashed our files when we tried to close the program from a minimized icon. Yet another bug caused a link failure when embedding Stanford Graphics charts into other applications via OLE (Object Linking and Embedding), and the table editor refused to accept numeric formatting or column alignment attributes. 3-D Visions attempted to resolve some of these problems during our testing period, but the program remained generally problematic.

We hope that the vendor will have enough presence of mind to fix the worst of these problems in subsequent maintenance fixes, but releasing a professionally priced product in this state is simply inexcusable.

If you need the power and think you can live with its design problems, by all means give Stanford Graphics a try. But step carefully, and be sure that you get a receipt. □

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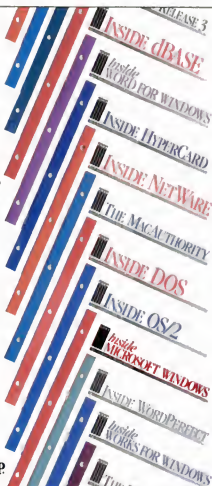
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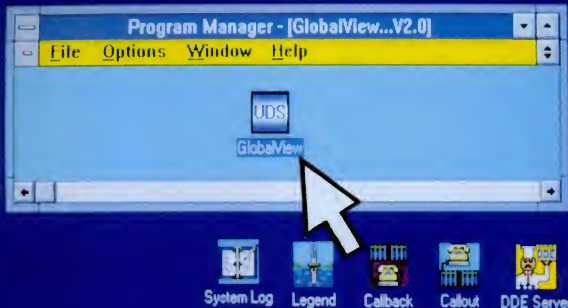
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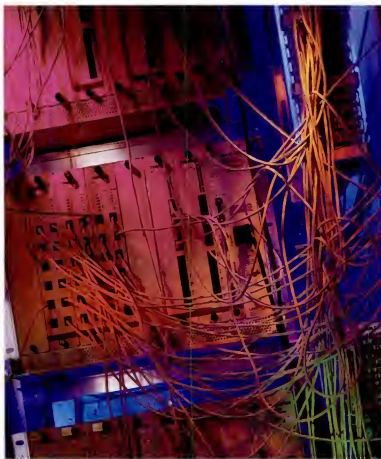


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WIRING THE INFRASTRUCTURE

Empire Builders: 6 Enterprise Hubs



Global networks require hard work, savvy, and an infrastructure that can handle today's applications—and tomorrow's. We review six wiring hubs that can help you build a powerful yet manageable network.

Rome wasn't built in a day, and your global network won't be either. But effective planning and the right tools can make setting one up easier. To build a powerful yet manageable networking empire that can grow with your needs, start at the center of the networking universe: the wiring hub.

Once simple devices linking a few dozen PCs, today's wiring hubs are packed with a dazzling array of technology capable of solving some of the most complex networking problems. If your goal is to establish sophisticated management and control over

IN THIS REVIEW

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by David Greenfield

an array of networks in the enterprise. These hubs will get you there.

With dozens of wiring-hub vendors in the market, which product do you choose? We help you answer that question by examining six wiring hubs that are uniquely suited to anchoring an enterprise: Cabletron Systems' Multi Media Access Center-M8FNB (MMAC-M8FNB), Online System Concentrator from Chipcom Corp., Lannet Data Communications' MultiNet LET-36, the LattisNet System 3000 from SynOptics Communications, the ODS 295 from Optical Data Systems, and the Access/One from Ungermann-Bass (UB).

These products form the center of a

star configuration, with cables radiating outward to connect the hub to various devices via Ethernet, FDDI (Fiber Distributed Data Interface), or Token-Ring. All the hubs offer some support for bridging or routing. And they all employ network management based on industry standards.

None of the products stands out enough from its competitors to earn an Editors' Choice. SynOptics' LattisNet System 3000 offers some of the best network management tools around, but it is far more expensive than the others we review. Cabletron's MMAC-M8FNB has a powerful network management interface. Chipcom's Online System Concen-

trator and Lannet's MultiNet LET-36 are the only devices we review that let you reconfigure the network through software. And UB's Access/One is the only enterprise hub to let you wire Macs, PCs, and terminals to hosts.

In return for the high-powered technology these products offer, you'll pay a hefty chunk of cash. Fully loaded, these packages run several tens of thousands of dollars. But for top-notch management across networks, enterprise wiring hubs are the way to go.

INTEGRATION IS KEY

Wiring hubs fall into three categories: enterprise, departmental, and workgroup.

HIGHLIGHTS

Enterprise Hubs

WE TESTED SIX vendors' wiring hub solutions for connecting local area networks into enterprise networks. Manageability, reliability, and flexibility are the key areas. Some hubs are on the cutting edge of such trends as full-motion video, zero-fault tolerance, synchronous Ethernet over fiber, high-speed asynchronous transfer mode (ATM), and integration of the server into the wiring hub.

WIRING HUBS DIVIDE into three categories. Enterprise hubs connect to or form the backbone. Departmental hubs typically connect to enterprise hubs or connect large workgroups to the backbone. Workgroups hubs are usually smaller and connect network devices to a departmental or enterprise hub.

THE FASTEST bridge modules for transferring 64-byte packets come from Cabletron Systems and SynOptics Communications, for 1512-byte packets from Optical Data Systems (ODS), for 1,024-byte packets from Cabletron and ODS, and for 1,518-byte packets from Cabletron, Chipcom Corp., and Optical Data Systems.

THE MOST EFFICIENT bridge for forwarding frames from one network to another comes from Cabletron.

THE BACKBONE of the network connects to the enterprise hub. You can have departmental hubs spiraling off the backbone, and smaller workgroup hubs linking onto the departmental hubs. To hold all this together, you'll need fault-tolerant solutions such as redundant power supplies, modules, and hubs to act as backups in case a vital piece of equipment fails. The products from Cabletron, Chipcom, and Lannet Data Communications let you create redundant connections as well.

HOT-SWAPPING features allow you to remove a module from the hub's chassis and replace it without turning off the hub. Cabletron, Chipcom, Lannet, and Ungermann-Bass hubs support this facility. The Chipcom and Lannet products let you swap modules through software, without touching the hub.

THE MORE SLOTS YOU HAVE in your hub's chassis, the more modules you can generally place inside them to add more functionality to your network. But expandability can also depend on the type of bus in your hub, the architecture of the backplane, whether there is enough room for larger backplanes, and if there are wiring traces built into the backplane to allow you to add new technologies.

MAKE CERTAIN YOUR VENDOR offers extra management buses that can address all the cards in the hubs. Without a separate management bus, you may not be able to retrieve management data under heavy traffic loads.

POWERFUL MANAGEMENT SOFTWARE is needed to run these systems. Most of the vendors' high-end management systems run over Unix and frequently interface with standard management systems like Sun Microsystems' SunNet Manager and Hewlett-Packard's HP OpenView. Ungermann-Bass runs its system over OS/2. Many vendors also offer less functional (and less expensive) Microsoft Windows and DOS versions. They communicate with other devices through Simple Network Management Protocol (SNMP).

THESE HUBS ARE EXPENSIVE. Enterprise hubs frequently cost in the tens of thousands of dollars. The bargain in the pack is Optical Data Systems' ODS 295. But if you're looking for a wiring hub to connect a local area network, hub cards that fit inside the slot in a PC instead of a pricey chassis are a convenient and inexpensive solution. Novell's recent hub management architecture (HMA) standard is making this solution lower in price and easier for more vendors to implement.



EDITORS' CHOICE

• Enterprise Wiring Hubs

Enterprise hubs connect to the network backbone or are used to build backbones. Departmental hubs typically attach to enterprise hubs and extend the wiring infrastructure across a floor or building, or they connect fairly large workgroups directly to the backbone. Workgroup hubs are smaller and connect PCs, Macs, and other network devices to a departmental or enterprise hub.

Enterprise hubs are designed around a modular chassis. Modules slide into the chassis and are connected by a series of buses. Each bus is typically a separate network. The modules range from simple concentrators to high-end workstations.

Integration is the real benefit of enterprise hubs. While you could purchase other, less-expensive products to make the connections enterprise hubs offer, you would have to spend time and additional money ensuring that all the products work together properly. The manufacturers of the enterprise hubs we review integrate the functions of these products into a single package. What's more, these hubs save plenty of valuable space, which is especially important in the cramped quarters of the wiring closet.

Not every client needs to be connected to a powerful enterprise hub, though. So part of your strategy must also be to use hubs of other sizes—departmental and workgroup hubs, for example—to make your enterprise network as cost-effective as possible.

Departmental (or specialized) wiring hubs are available from a number of vendors, including those whose products we review here. These hubs typically use a smaller chassis, accept fewer modules, and support only one type of network. They may offer extensive functionality within those parameters, however.

Workgroup wiring hubs have burst onto the scene with the explosive growth in small networks. These nonmodular products have the lowest entry price of any hub, typically around \$100 to \$150 per port. They are also network-specific: either Ethernet or Token-Ring. (There are also workgroup hubs for FDDI, but

None of the products reviewed here wins Editors' Choice, though each offers functionality that might suit your needs. SynOptics Communications' LattisNet System 3000, for example, is a great choice if you want the best management capabilities. The

hardware-management modules include handy filters to reduce information overload. The only component missing is SQL (structured query language) database integration in its main management programs. The LattisNet System 3000 offers sophisticated FDDI support on the network backbone, but no bridge. The main drawback, however, is the high cost of SynOptics' solution.

Optical Data Systems' ODS 295 is a highly capable hub and a comparative bargain. Although it lacks an FDDI concentrator module of its own, you can get around that by using it with ODS's 386 Connection Server module. This module is actually a functioning 20-MHz 386 PC that fits into a slot on the hub. If you would like, for example, to locate an on-board print server inside your wiring hub, ODS gives you this convenient feature.

Chipcom Corp.'s ONline System Concentrator offers good management and redundancy features. And its TriChannel Architecture lets you

they are far more expensive.)

You can buy many of these hubs without network-management capabilities to keep the entry price low. When you need network management, you can add a vendor's daughterboard or some other device that can manage the hub.

Another approach uses devices called hub cards. With these cards, vendors can concentrate on providing a hub while re-

swap ports and modules through software; you won't have to take the modules out of the hub and replace them. Chipcom's sophisticated programming features let you automatically reconfigure connections when the hub detects an overload. Lannet Data Communications' MultiNet LET-36 is the only other hub to let you reconfigure the network through software.

Ungermann-Bass's Access/One gives you flexibility with its wide choice of modules for performing all manner of network and internetwork functions. It also has strong SNMP capabilities, including a SQL database for storing SNMP information.

Cabletron Systems' MMAC-M8FNB provides flexibility, a wide range of networking modules and Spectrum, a sophisticated management station that lets you manage not only Cabletron components but also many third-party products. Cabletron's manuals for other vendors' products are in themselves valuable resources. Spectrum lets you manage the whole network, but at a high cost.

ly on Novell's network-management software. Resembling a network adapter with a dozen or so connections, the hub card slides into a PC or file server. At the time of this review, only Intel provided a hub card that complies with NetWare's management interface. Chipcom's hub card reworks the NetWare interface to cover Token-Ring (see "The Low-Cost Alternative").

Our Contributors: DAVID GREENFIELD is the associate editor of *PC Magazine's* networking and communications team. PADRAIC R. BOYLE is senior networks analyst for Ziff-Davis Publishing Co. JEFFREY L. CARRELL is a senior communications systems engineer for a large transportation company.

REVIEW CRITERIA

To be included in our review, the products had to offer support for Ethernet, FDDI, and Token-Ring; a modular chassis;

sis; support for SNMP (simple network management protocol); and an inter-networking module.

Enterprise networks need to handle many different wiring combinations. Support for the three major access methods gives you that flexibility. With Ethernet and Token-Ring support you'll be able to connect most workgroup devices; with FDDI support, the enterprise hub can connect to a high-speed backbone or form that backbone itself.

Connecting the different types of networks is also important. While none of the vendors could give us a single module that tied these networks together, the technology is headed in that direction. We did require the products to offer internetworking support, either through bridge or router modules.

Since the hub is crucial to the network's reliability, it needs the compatibility that SNMP offers. With SNMP, a single station can gather and integrate information from different vendors' devices, thus simplifying network management and enabling you to correct emerging problems.

Not all enterprise networks require a hub that supports Ethernet, FDDI, and Token-Ring. Managers of less complex environments can choose among a number of products that were not included in this review because they didn't meet all or part of our criteria. David Systems, for example, offers a hub that supports Ethernet, FDDI, and Token-Ring but had no bridge at the time of our testing and has no router. Alantec, Fiberonics, Synernetics, and 3Com Corp. offer FDDI-Ethernet wiring hubs, but didn't offer Token-Ring support at the time of our testing. Fibermux Corp. offers a hub that supports Token-Ring and Ethernet but not FDDI. Bytex Corp. offers a software-reconfigurable enterprise hub that supports Ethernet and Token-Ring but not FDDI. A slew of vendors, including Ascom Timeplex, AT&T, DEC, Hewlett-Packard, and IBM offer wiring hubs with support for FDDI, Ethernet, or Token-Ring, but not all three.

IT'S ALL IN THE BUS

Selecting the right wiring hub means looking at the hub and its backplane, the types of modules offered, and the functionality of the management station.

Suitability to Task: Enterprise Wiring Hubs

Enterprise wiring hubs not only connect the PCs on a LAN, they provide the flexibility to perform a number of network functions that can benefit network administrators and network users in general. Rather than rating only the individual chassis and modules here, we evaluate the vendors' entire line of hub solutions, including the software sold by the vendor.

Management rates how useful the product line is in administering the network. SNMP (Simple Network Management Protocol) capabilities for accessing MIB (management information base) data, and remote serial-line support are important. The SQL (structured query language) database should allow you to make queries about various network components. Context-sensitive, on-line help should be available at all times, and you should be able to keep a log of events in a file that you can export to other applications.

Troubleshooting evaluates the product line's ability to monitor and test the performance of the network and detect problems. The products should provide a clear, graphical display of all the elements available on the hub, down to the port level; indicate their activity and status; and offer real-time visual detection of problems such as disconnected modules. The hub should be able to use SNMP to provide dynamic traffic information and remote diagnostics, and let you set thresholds for detecting faults. A database of resolutions for problems and a log of statistics that you can also display graphically and import to other programs are other useful troubleshooting features.

Expandability refers to the product line's ability to handle the extra modules, ports, or devices you

Two characteristics of the wiring hub largely determine its expandability: the number of slots on the chassis and the individual bus architecture connecting the slots. With more slots, the hub can hold more modules and hence offer more functionality. The vendors in this review all provide chassis of different sizes.

More subtle but just as important are the capabilities of the individual buses connecting these slots. All of the vendors reviewed provide nonsystem buses to connect the slots. With a nonsystem bus,

SUITABILITY TO TASK

Product Name

	POOR	FAIR	GOOD	EXCELLENT
Management	●	○	○	○
Troubleshooting	●	●	○	○
Expandability	●	●	●	○
Fault tolerance	●	●	●	●
Bridging and routing	●	●	●	●

might want to add to a local or enterprise-wide network. The hub should be easy to customize and have a large number of slots that easily accept the modules you insert. Hot-swapping capability allows you to insert or remove modules without downing the hub. The hubs should automatically detect the modules you place inside them and work with other vendors' products. Support for IP (Internet Protocol) and other platforms, such as Apple's Macintosh, are two more pluses.

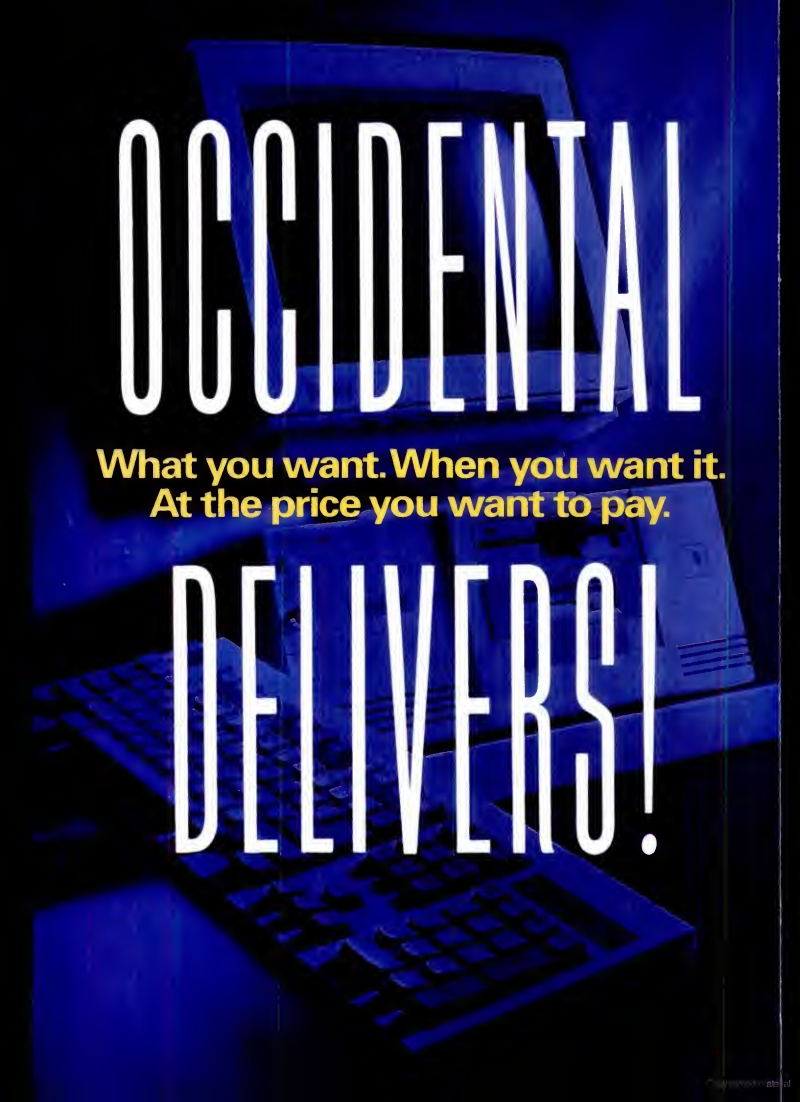
Fault tolerance rates the features that protect the network from problems in the hub or in modules.

The ability to recognize and respond to alarms, a remote-control reset feature, threshold capability, and redundant features such as extra power supplies and hubs help maintain the reliability of the network.

Bridging and routing evaluates the capabilities of the bridge and router modules. Important bridge features include transparent bridging (where the bridge learns the client PCs' addresses and builds a reference table), source routing, and the spanning tree algorithm. Helpful router features include RIP (routing information protocol) and the OSPF (open shortest path first) technique. Routers may also interroute the packet for protocol information, such as logical addresses, and filter out specific packet types.

arbitration is carried out by the access method—Ethernet, FDDI, or Token-Ring—running across the bus. The nonsystem bus merely passes the signals from one module to another, much as a cable carries signals between network devices.

In contrast, a system bus, such as the EISA, ISA, and MCA designs in PCs, requires the modules to assert interrupts to gain control. This type of bus carries a variety of traffic. The PlusBus in UB's Access/One is the only example of a system bus provided in these wiring hubs.



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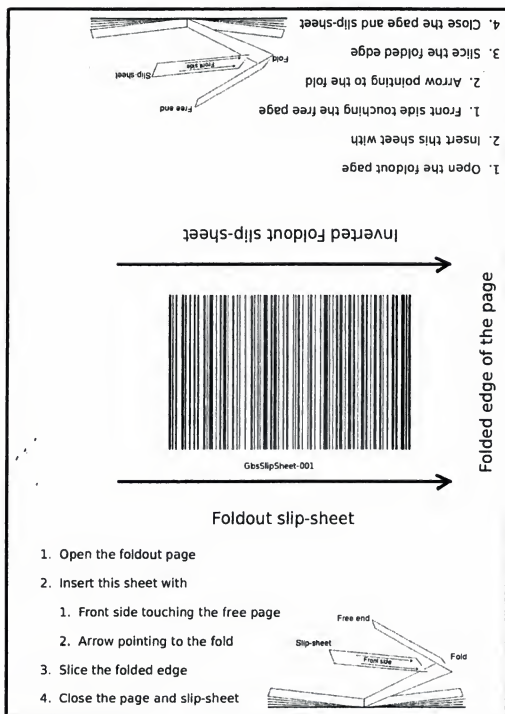
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A product's flexibility is determined by how well the vendor allows for expansion. SynOptics, for example, claims that you can add or upgrade the backplane on the LattisNet System 3000. If the product you choose takes this approach, be sure that there's enough physical space to accommodate a new backplane.

If there isn't enough room, the backplane will be limited in the functions it can provide. Another strategy, used by all the vendors except Cabletron, is to build enough traces into an existing backplane to accommodate new technologies.

Lannet and Cabletron have tried to enhance the flexibility of their hubs with a third approach, the segmented backplane. Both these vendors divide a single bus into separate sections, each joined by a connector. Modules plug into these connectors and automatically sense if there's

traffic on either section. If there is, the module can either try to connect to that network or create a separate network. The segmented backplane gives you future expandability with today's bus design. Often there is an additional configuration required to set up the wiring hub.

Chipcom uses a related approach. By using a multiplexing technique, it can divide one physical bus into three virtual buses of any configuration. While this gives users increased flexibility, it also adds cost (see "Catching the Bus").

Whatever its approach, be sure the vendor you buy from offers an extra management bus. Also make certain that the management bus can simultaneously address all the modules you'll need. With an extra bus, you'll be able to retrieve management data quickly even if network traffic is heavy.

Not all hubs provide separate management buses. ODS's 295 is one that doesn't. When we saturated the network traffic, its management station was unable to retrieve data from the hub's agent. Lannet provides a management bus for its device, but it does not enable you to manage all modules simultaneously.

Increasingly, wiring hubs are incorporating industry-standard buses onto their backplanes. UB's Access/Open, for example, can support EISA, ISA, or MCA option cards. By incorporating a standard bus, hubs can take advantage of PC option boards.

In a related trend, ODS and other manufacturers are providing file servers in their hubs. This adds reliability by letting you take advantage of such features as hot swapping—the ability to remove modules during network operation.

A Hub Glossary

asynchronous transfer mode (ATM) A specification for transferring any type of data at up to 155 megabits per second. ATM is viewed by many as the next-generation network specification that will provide a single connectivity solution for local and wide-area networks.

backplane vs. bus These two terms are often used interchangeably in the hub industry. When we refer to the bus in this article, we mean the group of traces that connect modules or other components. The backplane is the board that contains the bus.

bridges vs. routers These are two ways of connecting networks. Bridges function at the MAC layer, making a decision to forward a frame to the connected network based on the MAC address. Routers function at the network layer, using addressing information provided there to decide whether or not to move the frame onto the adjoining network.

concentrators vs. MAUs vs. hubs Concentrators are typically Ethernet devices that connect client PCs, servers, printers, and other networking equipment. A multistation access unit (MAU) is a similar device that is aimed at Token-Ring networks. It can be a standalone product or be sold as a module that slides into a chassis. The chassis, any installed modules, and the management station comprise the hub.

Ethernet vs. 10BaseT vs. 10BaseF Ethernet is a method of arbitrating access to a cable. Basically,

attached devices listen to the cable. If it's free, they transmit data; if not, they wait. If two devices transmit simultaneously, they wait before retransmitting. 10BaseF is the spec for running Ethernet over fiber-optic cabling. 10BaseT is the spec for running Ethernet over unshielded twisted-pair cabling.

FDDI (Fiber Distributed Data Interface) FDDI is another method for arbitrating access to a cable. It operates at 100 megabits per second and uses a special frame called a token to control access to the cable. The token travels around the network. Any station that wants to transmit data grabs the token. All other devices on the network examine the data.

in-band vs. out-of-band These are two ways of communicating management information. With in-band management, information is communicated across the network. With out-of-band management, data is communicated through another link, typically a modem or some other serial connection.

media access control (MAC) The MAC layer is that part of the ISO (International Standards Organization) model that describes how devices share access to the network. Token-Ring, Ethernet, and FDDI are MAC-layer specifications. Wiring hubs primarily deal with MAC-layer equipment.

management information base (MIB) The spec for how data is stored in an SNMP device. Vendors have their own MIB extensions to customize SNMP

for their devices. Be sure your hub's management station can easily extract information from other vendors' MIBs.

Remote Monitoring MIB (RMON) The MIB that enables any SNMP management console to extract information from a protocol analyzer running RMON. If you're looking for a protocol analyzer in a hub, there's a great chance that you'll want RMON support. Be careful, though. RMON consists of nine sections, but vendors don't need to support all nine to claim RMON compliance. Look for complete RMON support.

Simple Network Management Protocol (SNMP) SNMP is a language for exchanging information about a device. SNMP management stations are those devices that display management information. An SNMP agent is the software in the various devices that gathers the management information.

terminal server A device that connects terminals to a network that is typically running Ethernet. Most of the wiring hubs reviewed in this feature offer terminal servers.

Token-Ring An access method that operates conceptually the same way as FDDI, but at a lower speed, either 4 or 16 megabits per second.

traces Copper runs, or wires, on integrated circuit boards, used within buses for connecting two points.

TIES THAT BIND

The backplane may provide the long-term functionality of the enterprise network, but the modules are what provide capabilities today. Vendors offer a staggering selection of modules. Cabletron, for example, offers more than 50 different products.

Because of that vast array of functionality, most vendors find cooperating with other networking vendors to be crucial: It's simply too hard for most vendors to produce all of the products themselves.

If you purchase a wiring hub that incorporates products from other vendors, be sure to ask some questions. First, is the wiring hub vendor trained to answer your questions on all the different products? If not, getting service and support may be a problem. Second, can the OEM upgrade a product or must you wait for the wiring hub vendor to release its own upgrade? In the past, SynOptics, for example, made customers wait for its release of an upgrade to its Cisco Systems router, even though Cisco had already made that upgrade available for its own external routers.

MODULE RECOMMENDATIONS

The capabilities of a hub's modules are likely to be what makes the hub attractive, but in assessing potential benefits don't overlook seemingly small aspects of a module's design and makeup. Size, for example, determines the number of components that can fit on a given module—and hence its functionality. Complex technology, like high-speed Ethernet-to-ATM bridges, is typically first available on large external products before it appears on smaller internal wiring-hub modules.

The connectors attaching these modules to the backplane are also important. Male connectors should be placed on the module so you can replace a damaged connector with a new module. If the damaged male connector is on the backplane, you'll need to replace the backplane, not an easy job. SynOptics is the only vendor in this review to supply male connectors on the backplane.

Externally, the modules should also be easily distinguishable. They should have a consistent look and feel but not be so similar that you may confuse them with each other. In addition to offering

clearly marked panels, all of the vendors provided plenty of LEDs with information on port and module configurations.

Reliability and fault tolerance are also important. All of the products let you create redundant hubs for greater fault tolerance, but only the MMAC-M8FNB, the ONline System Concentrator, and the MultiNet LET-36 allow you to create redundant links between wiring hubs and stations so that a backup will automatically switch on if a fault occurs.

Be careful of vendor claims concerning module functionality. Two vendors may claim that their products support the same feature—but the claims may mean two very different things. Cabletron, for example, claims that its product supports the remote monitoring (RMON) management-information base (MIB), the nine-part specification for gathering information from a remote protocol analyzer. But Cabletron's hub supports only four of the nine specifications while the SynOptics and UB products support all nine levels.

WINDOWS INTO THE HUB

None of these wiring hubs would be of much use if they didn't offer sophisticated network management. The management station is what enables you to take advantage of the features these hubs offer. With the right management software, you can peer into a wiring hub from across the floor—or even from across the country.

Management stations are complex. This review focuses on the wiring hub and aspects of the management station germane to the hub. We did not review all aspects of the management station.

The vendors whose products we review offer two tiers of network-management software. For corporate network managers looking to manage the enterprise, most vendors provide a Unix-based management platform. This software runs on a high-end workstation such as a Sun SPARCstation and lets you gather extensive information about all aspects of the network. UB is the only

exception; it bases its network-management strategy around OS/2. The Unix-based platform is typically the premier product, offering the most sophisticated management tools across the greatest number of networks.

A less powerful management solution, typically based on DOS or Windows, provides the departmental or corporate-wide network manager with a cost-effective solution for managing the network. Such a system will often allow you to gather many of the same statistics as the Unix platform but will typically be limited to managing one network, be it Ethernet, FDDI, or Token-Ring.

Wiring hubs are a significant investment, but they aren't the only network devices you'll need. Typically, networks also require a host of external devices from other vendors. Managing those devices, and allowing other management consoles to access the hub, is crucial. That is why many of the vendors whose products we review here base their management consoles on SNMP management platforms such as SunNet Manager and HP OpenView.

Under such a setup, information is gathered from the different networking products and stored in a common database. This allows different views into the data and also lets you take advantage of third-party applications written for SunNet Manager or HP OpenView.

Four of the vendors whose products we review—SynOptics, Chipcom, ODS, and Cabletron—support either HP OpenView or SunNet Manager. Cabletron also offers a competing product, Spectrum, as the basis of its high-end station. Lannet also has its own Unix-based management platform, though it has announced a version of its management platform for HP OpenView.

Look for a single module that can manage all networks. This will save on the number of slots you must devote to network management. To help ensure network reliability, purchase two such modules and be sure the vendor's hub can automatically switch between them.

Wiring hubs are a significant investment, but they aren't the only networking device you'll need.

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Competitive Analysis

	Tecmar 720	Brand X	Brand Y
Capacity	720 MB	525 MB	525 MB
Speed	15 MB/min	11 MB/min	11 MB/min
Software	DOS, OS/2, Windows, Novell	DOS, OS/2, Windows, Novell	DOS
Price	\$1888	\$3695	\$3995

Prices include adapter and software.

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► BENCHMARK TESTS

Bridging in Wiring Hubs

Two criteria are crucial for fast and dependable throughput over a bridge. The first is the speed at which data can be processed; the second is how well the vendor tunes the software to eliminate excess overhead. Top performance in both areas indicates a bridge that carries packets between two networks quickly and efficiently.

WHAT THE RESULTS MEAN

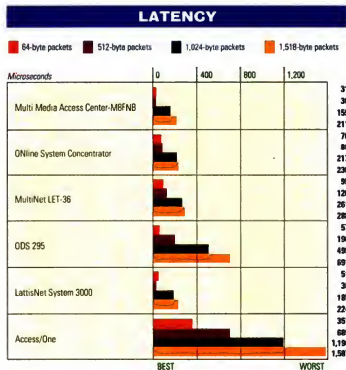
Our findings show that proper use of the CPU's speed and power, and the right firmware algorithms, eliminates extra overhead. Products from three vendors—Optical Data Systems (ODS), Cabletron Systems, and Syn-Optics Communications—were effective at eliminating overhead on the 64-byte packet Latency test. As the packets increased in size, all of the products exhibited roughly the same through-

put, except for Ungermann-Bass's (UB's) Access/One, which had lower scores on this test.

With the exception of the Access/One and the ODS 295, all of the products exhibited pretty much the same degree of latency, or delay in processing frames. The Access/One and the ODS 295 were significantly slower. UB points to custom-filtering and enhanced security features as part of the reason for the poor throughput and la-

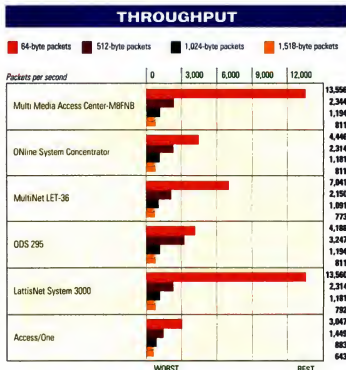
tency scores. The Access/One offers the ability to direct packets according to a MAC-layer address and an ID address burned into the hardware by the manufacturer.

The ODS 295 had fairly high throughput and latency. It uses the Fujitsu Ethernet chip set, which has built-in buffering to let it to store more frames. We suspect this capability compensates for the 295's less efficient address lookup.



HOW WE TESTED

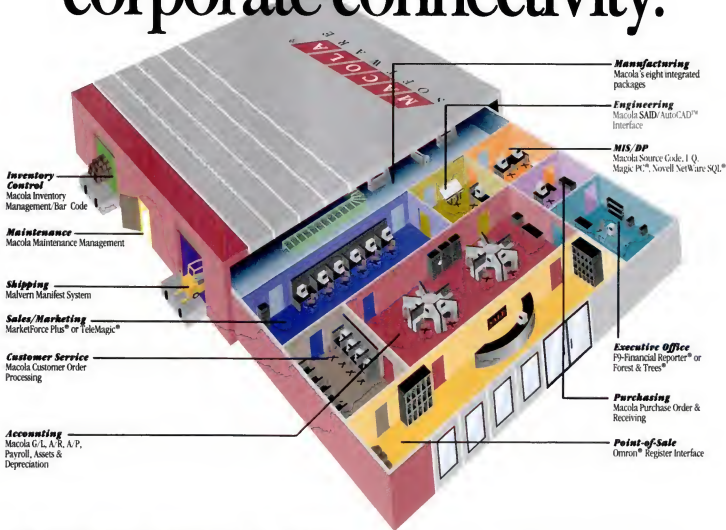
To test these internetworking devices, we used the Wandel and Goltermann DA-30 Multi-port Dual Protocol Analyzer, a dual-ported Ethernet protocol analyzer. We used the DA-30 for two bridging tests: a Throughput test and a Latency test. Both of these tests used one stream of packets. We considered using multiple streams with Alantec PowerBits, a traffic generator, but none of the products that were reviewed here offered a multiport Ethernet-to-Ethernet bridge. Both tests were run for bridges. We selected four sizes of packets: 64, 512, 1,024, and 1,518 bytes.



The **Throughput Test** shows the performance of a single port on the bridge. We saturated one Ethernet segment with various packet sizes. Each stream was sent from the DA-30 through the bridge; it was received by one incoming port.

The **Latency Test** shows the amount of time it takes to forward a single frame from one network to another. Latency is particularly important when a packet must go through multiple bridges or routers to reach its destination. Each packet was sent from the DA-30, through the bridge, and then received by one incoming port.

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INFORMATION MANAGER

Add a device to the network and you make the network more powerful, but you also make it more complex. You may have a problem with too much management information, not too little. The tools vendors are supplying to manage this information fall into four broad categories: accounting management, configuration management, fault management, and performance management.

Accounting-management tools report on how the network is currently being used. Charts that can be updated in real time are the norm here. The reviewed products also let you choose from an array of predefined reports. With the exception of the ODS 295, these hubs enable you to export the data to other formats for analysis by outside packages.

Configuration-management tools make it easier to add or remove network users. All of the products we review provide a graphical, hierarchical view of the network. By clicking on icons, you can zoom from a view of the enterprise network to a view of the operations of an individual port.

At first glance this interface may seem more glitzy than necessary, but it helps you navigate through your network quickly and easily. Typically, the images are updated in real time or at predefined polling intervals. UB was the only vendor whose product did not offer a completely graphical interface—the individual module view it provided was a difficult-to-read table of numbers.

Other monitoring tools vary among hubs. Cabletron's hub, for example, offers a logical view of the network, which allows you to see the traffic patterns between network nodes. SynOptics' hub offers a tool called MeterMan that provides a summary of the network's health.

Fault-management tools allow you to isolate and identify network problems. Many of them enable you to automatically isolate ports from the network if an excessive number of bad frames is received or if a station starts beaconing on a Token-Ring network. All of the prod-

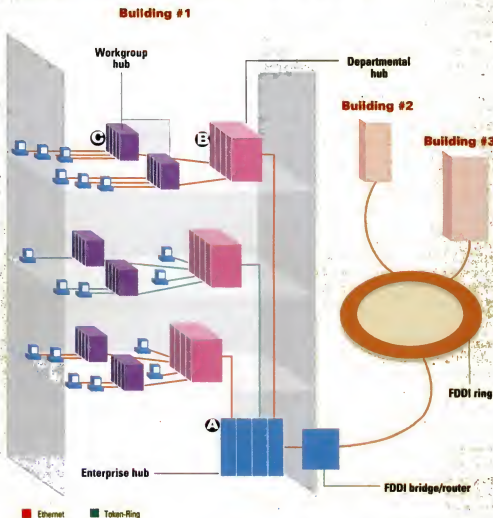
ucts we review allow you to gather detailed MAC- (media-access control) layer statistics to troubleshoot network problems. A protocol analyzer enhances this capability with more information about network traffic.

Performance-management tools enable you to gather network statistics and use that information to plan for growth. All of the hubs we review gather low-level statistics on a port-by-port basis. Cabletron augments those tools with a protocol-analyzer module. SynOptics offers a protocol-analyzer application that runs on its Network Control Engine (NCE). Both products monitor network traffic and break it out by protocol and volume, to a name a few criteria.

A Hub for Every Taste

There are three types of wiring hubs: enterprise, departmental, and workgroup. Enterprise hubs connect many Ethernet and Token-ring networks to a FDDI backbone (A). Departmental hubs offer much of the functionality of an enterprise hub but typically

only for Ethernet or Token-Ring (B). Workgroup hubs are the least expensive and least versatile of the hubs. They typically connect a smaller number of PCs and other devices together via Ethernet or Token-Ring (C).



BIGGER, FASTER

During the next year, these hub vendors will be in the middle of new product introductions. All plan on offering hubs that can handle a new breed of network applications employing full-motion video and multimedia across the network.

If networked multimedia applications are to succeed, networks themselves will have to change fundamentally. Routinely passing 5MB files around one of today's networks can quickly grind it to a halt. Higher-speed LANs are needed to handle such files.

FDDI, with 100 megabits per second of bandwidth, offers promise, especially now that it is less expensive thanks to the adoption of twisted-pair cabling. Still,



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FDDI is far from cheap when compared with Ethernet or Token-Ring, and it's not on most of today's networks.

An even more important problem is that, even with its speed, FDDI still doesn't support isochronous or real-time data, which is exactly what multimedia requires. Neither Ethernet, FDDI, nor Token-Ring is designed to ensure delivery of isochronous data. An enhancement to the FDDI protocol, FDDI II, will deliver isochronous bandwidth, but FDDI II is not yet available.

A final problem plaguing FDDI is software reconfigurability. As networks become part of the standard corporate infrastructure, many managers would like to provide a level of service as flexible as that offered by a telephone network. The paradigm of the telephone network has led some vendors to explore the idea of reconfiguring networks through software, a capability now provided in the Chipcom and Lannet hubs.

With a software-configurable network, you can move stations between networks with a click of a mouse. By building intelligence into the hub, the vendor can configure the hub to respond dynamically to changes in the network. However, software reconfigurability in today's implementations can't easily scale to very large networks. A completely reconfigurable network will require running a separate network connection between hubs for each network that connects to the hub. If four networks are connected to the hub, four network connections must be provided back to the backbone (see "Software-Reconfigurable Networks: Fact or Fantasy?").

ASYNCHRONOUS TRANSFER MODE (ATM)

Three goals—throughput, isochronous data, and reconfigurability—are leading many vendors to a new high-speed data-transfer technique called asynchronous transfer mode (ATM). ATM runs at 100 or 155 Mbps and supports voice and data over a common network. Not surprisingly, ATM was originally aimed at carrying voice and data across a wide-area network (WAN).

ATM uses a complex network of switches to move 53-byte frames, called cells, quickly between ports. Each port is in turn connected to a specific device. Because each switch follows instructions

within the cell, this technique enables you to route a cell to the correct device no matter where it is located. Such small frames (frames on Ethernet, for example, can exceed 1,500 bytes), can be quickly switched, ensuring only a short delay.

The great interest in ATM lies in the fact that it can support both isochronous and nonisochronous data. What's more, because the cells are switched and because over the long-term ATM is expected to be supported by both LANs and WANs, you'll be able to reconfigure the network through software, regardless of the location of the hub or even the building. A user in New York and a user in San Francisco will, in theory, be seamlessly tied into an integrated network.

Already, a number of hub vendors, including Fibermux Corp., SynOptics, and UB, have announced support for ATM. UB inked an agreement with BBN Communications to provide ATM products in mid-to-late 1993. SynOptics hasn't set a date yet for delivery of its ATM solutions. Fibermux, a company whose products were not considered for review because they lacked FDDI support, also expects to ship ATM products in roughly the same time frame.

NOT A SURE THING

While ATM offers great promise, some significant obstacles must be overcome. One area that critics point to as a problem is congestion control. ATM does not currently specify how to handle two cells needing to be processed simultaneously for the same port. Buffering helps, but as the critics note, the idea behind ATM is to have a network where there's no delay—that is, no buffering.

Pricing and availability are also concerns. With products not shipping until next year and pricing sure to be at the very high end, ATM won't be a practical solution for many users for awhile.

Until then, users will have to make do with what they have. Extending the life of today's networks is crucial if network managers are to run multimedia applications over the network. And with most

Token-Ring networks still running at 4 Mbps, the need for a higher-speed network may almost exclusively become an obsession in the Ethernet community, where many networks today are reaching saturation.

Instead of requiring you to rip out cabling, a number of vendors are actively promoting a switch-based Ethernet solution. As with ATM, the workstations are wired using Ethernet and the network is linked back to a switch. Today, the switch is a standalone product. In the future, the module will sit inside the wiring hub.

By fitting inside the hub, the switch will enable the user to migrate to a switch module from a concentrator module without changing the cabling plant. Better yet, we expect switching technology to be offered in a daughterboard that mounts onto the concentrator module. In this setup, each user can get nearly 10 Mbps of bandwidth without scrapping an existing investment.

Earlier this year, SynOptics announced that it will offer an Ethernet switching module based on technology from Kalpana, the first vendor to promote this Ethernet switching. Alantec and Synernetics, two companies that did not meet our filter criteria, offer a similar capability.

Lannet and Alantec have taken the concept of switched Ethernet a step further. With a new agreement with Starlight Networks, Lannet will enable users to run compressed video over a switch-based Ethernet network. The new product currently being demoed allows more than a dozen users to run full-motion video over the LAN. The product uses special networking code to prioritize requests going across the network.

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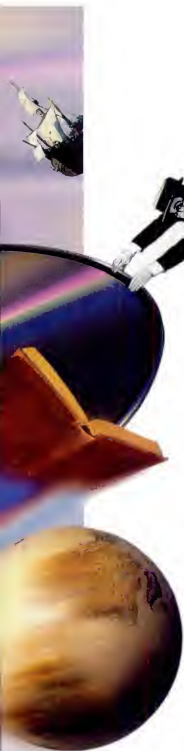
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► **S U M M A R Y O F F E A T U R E S**

Enterprise Wiring Hubs

In alphabetical order by company	Cabletron Systems Inc. Multi Media Access Center-M8FNB	Chipcom Corp. ONline System Concentrator	Lannet Data Communications Inc. MultiNet LET-36	Optical Data Systems Inc. ODS 295	SynOptics Communications Inc. LattisNet System 3000	Ungermann-Bass Inc. Access/One
■ = YES □ = NO						

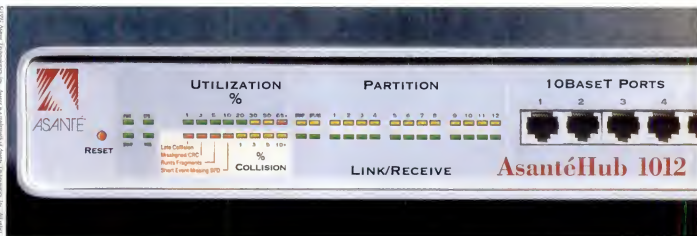
Physical Characteristics (tested configuration)						
Size (HWD, in inches)	13 x 17 x 21	7 x 17 x 14	11 x 19 x 11	12 x 17 x 17	19 x 19 x 12	23 x 19 x 12
Weight (empty, in pounds)	21	12	48	31	33	33
Weight (fully loaded, in pounds)	28	17	75	50	75	60
Maximum number of slots on chassis	8	17	36	12	12	11
Maximum number of networks on the backplane	7	7	12	3	10	1
Ethernet	7	3	4	3	5	1
FDDI	7	4	2	None	3	None
Token-Ring	7	7	2	3	2	None
Maximum number of available ports (with management module and power supply installed)	168	180	224	176	264	120
Ethernet	168	180	224	132	264	120
FDDI	52	32	64	N/A	40	52
Token-Ring	168	142	160	176	132	120
Separate management bus connecting the modules	■	■	■	■	■	■
Support for hot swapping	■	■	■	□	■	■

Module Options Available						
Remote routers	■	■	□	■	■	■
Local router	■	■	□	■	■	□
Remote bridge	■	□	□	■	■	■
Local bridge	■	■	■	■	■	■
Switch	□	□	□	□	■	□
Protocol analyzer	■	□	□	■	■	■
Server	□	□	■	■	■	■
Workstation	□	□	□	■	□	□
Terminal server	■	■	■	■	■	■
Ethernet concentrator	■	■	■	■	■	■
FDDI concentrator	□	■	■	□	■	■
FDDI backbone attachment	□	□	■	□	■	■
Token-Ring concentrator	■	■	■	■	■	■
Ring-in and ring-out connection	■	■	■	■	■	■
LocalTalk	■	□	■	■	■	■

Routing and Bridging						
Manufacturer of router or bridge	Cisco Systems	Cisco Systems, Chipcom Corp.	Lannett Data Communications	Optical Data Systems	Cisco Systems, Retix Corp.	ACC Systems, Ungermann-Bass
Routing protocols supported:						
Integrated IS-to-IS	□	□	N/A	■	■	□
IS-to-IS	■	■	N/A	■	■	□
OSPF	■	■	N/A	■	■	■
RIP	■	■	N/A	■	■	■

N/A—Not applicable. The product does not have this feature

CONTINUES



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Combining the AsantéHub 1012 and AsantéView™ management software creates the industry's first smart hub with both in-band (SNMP) and out-of-band network management for both PCs and Macs® that uses the same graphical user interface. That means you can graphically monitor and control your entire network, locally or remotely, from your choice of computer platform.

Smart Remote Network Management.

AsantéView gives you direct control of your network at the hub and port levels. The software can even trigger your pager to give you the flexibility to solve your office network problems when you're not there.

The AsantéHub includes a built-in expansion slot for internetworking option cards. Asanté offers an in-band SNMP hardware module as an option for this slot. The hub also features an RS-232 port for remote dial-up access, and both RJ-45 and RJ-21 connectors for direct-to-computer or

punch-down block connections.

There is also a 3-in-1 "13th" port for interconnecting multiple hubs with backbone cabling. This port includes BNC, RJ-45 and AUI connectors supporting a variety of cabling media.

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Asanté has built a reputation for producing compatible, reliable and flexible networking products. We offer a full family of Ethernet® and Token Ring adapter cards for PCs and Macs. And a full line of 10BaseT hubs. We're the networking company of choice because we give you more choices.

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Resellers: Asanté products are available from Ingram Micro, Merisel, and Tech Data.



[In-band or out-of-band network management from a Mac or PC, using the same graphical user interface.]



[3-in-1 auto-switching redundant backbone ports with software override capability.]



[Remote out-of-band management lets you manage your network from anywhere in the world.]

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ALL THE RIGHT CONNECTIONS™

► SUMMARY OF FEATURES

In alphabetical order by company

■ = YES □ = NO

**Cabletron
Systems Inc.
Multi Media
Access
Center-M8FNB**

**Chipcom Corp.
ONline System
Concentrator**

**Lannet Data
Communications
Inc.
MultiNet LET-36**

**Optical Data
Systems Inc.
ODS 295**

**SynOptics
Communications
Inc.
LattisNet System
3000**

**Ungermann-
Bass Inc.
Access/One**

Routing and Bridging (continued)

RIP	■	■	N/A	■	■	■
Network protocols routed or bridged:						
AppleTalk	■ ■	■ ■	□ ■	■ □	■ ■	■ ■
DECnet Phase V	■ ■	■ ■	□ ■	■ □	■ ■	□ □
NetBIOS	■ ■	■ ■	□ ■	■ □	□ □	■ □
SPX/IPX	■ ■	■ ■	□ ■	■ □	■ ■	■ ■
TCP/IP	■ ■	■ ■	□ ■	■ □	■ ■	■ ■
XNS	■ ■	■ ■	□ ■	■ □	■ ■	■ ■
Maximum number of network addresses supported	8,192	8,192	5,000	4,096	8,192	16,000

Token-Ring Concentrator Modules

Number of ports	10, 12, 24	6, 8, 20	4, 5, 6, 10	10, 16	12	12
Modules supporting UTP	10-, 12-, 24-port	8-, 20-port	4-, 6-, 10-port	16-port	12-port	12-port
Modules supporting STP	10-, 12-, 24-port	8-, 20-port	4-, 5-, 6-, 10-port	16-port	12-port	12-port
Shielded connection	■	■	□	■	■	■
Modules supporting multimode fiber	None	6-port	4-, 5-port	10-port	12-port	None
Helps eliminate jitter	■	■	■	■	■	■
Helps eliminate near-end crosstalk	■	■	■	□	■	■
Logically switches ports to any network	□	□	□	□	□	□
Auto-wrapping	■	■	■	■	■	■
Automatically isolates a beaconing signal	■	■	□	■	■	■
Error-detection logic on concentrator module	□	□	□	□	□	■
Error-detection logic on separate network management module	■	■	■	■	■	□

Ethernet Concentrator Modules

Number of ports	6, 12, 24	2, 3, 4, 6, 8, 12	1, 2, 4, 5, 8, 10, 12, 14	4, 12	6, 8, 24	12
Modules supporting voice-grade UTP	12-, 24-port	8-, 12-port	4-, 8-, 10-, 12-, 14-port	4-, 12-port	24-port	12-port
Modules supporting data-grade UTP	12-, 24-port	8-, 12-port	4-, 8-, 10-, 12-, 14-port	4-, 12-port	24-port	12-port
Modules supporting thick coax	12-port	2-, 3-port	1-, 2-port	4-, 12-port	8-port	12-port
Modules supporting thin coax	12-port	6-port	2-, 5-port	4-, 12-port	8-port	12-port
Modules supporting single-mode fiber	6-, 12-, 24-port	None	2-port	4-, 12-port	None	None
Modules supporting multimode fiber	6-, 12-, 24-port	4-port	2-port	4-, 12-port	6-port	12-port
Logically switches ports to different networks	□	■	□	□	□	□

FDDI Concentrator Modules

Number of dual-attached connections	7	None	2	N/A	2	1
Number of single-attached ports	52	8	4	N/A	8	14
Supports data-grade UTP media	■	□	□	N/A	■	□

N/A—Not applicable The product does not have this feature

CONTINUES

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★ Star Trek: The Screen Saver

Beam aboard the Enterprise with Captain Kirk and Mr. Spock on a mission to prevent screen burn-in. Exciting trilling Tribbles, Klingon battlecruisers, and harrowing horta. This all new screen saver provides over 15 animated displays, password protection, System IQ and full compatibility with After Dark. **Publisher: Berkeleys Systems GR5883**



\$39

TrueType for DOS

TrueType for DOS is a collection of 46 TrueType fonts especially for the DOS versions of WordPerfect, Microsoft Word or Microsoft Works. Print from 2 to 1000 points using any Dot Matrix, Inkjet or Laser printer. With TrueType for DOS you can easily combine fonts with thousands of high-impact special effects including patterns, outlines, shadows, and reverse effects. You're free to be creative, and let's admit it - just have fun! **Publisher: MicroLogic Software GR5754**



\$56



★ CorelDRAW! 3.0

A new Era in PC Graphics! CorelDRAW! winner of over 50 international awards, is the PC graphics software for everyone! CorelDRAW! 3.0's enhanced features include graphic design layers, editable preview, improved 3D effects, and powerful data-driven charting, paint and photo editing, and presentation packages. CorelDRAW! 3.0 PHOTO PAINT, and CorelDRAW! 3.0 comes with 155 TrueType fonts, and over 4000 symbols and clip art images. And as an unprecedented bonus, Corel has included a CD-ROM with over 12,000 clip art images and over 250 fonts! Also included: dozens of fill patterns, dotted and dashed line styles, and arrowheads, 31 import/export filters, five Panotype and TRIMATH31 licenses, and free utility programs - CorelTRACE and Mosaic. **Also Available on CD ROM, CDS0580 \$369. Publisher: Corel Systems GR5443/5**

\$379

DesignCAD 3D 4.0

DesignCAD 3D, PC Magazine Editor's choice, and Computer Shopper "Best Buy". Easy-to-use modeling software that allows you to drill, hammer, slice, subtract, and extrude solid and wireframe objects! Also, 3D text and 3D dimensioning! Next "Real Time" view positioning. Great designing tool for architecture, engineering, art, hobbies and illustration (transfers easily into WordPerfect, PageMaker, and DWF). Plus: Rendering with textures, volume/area calculations, basicCAD Programming Language. **Also available for Drafting and Design. DesignCAD 2D 5.0 C40203 \$175 Publisher: American Small Business**



DesignCAD 3D 4.0 C40235/5

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★ FastLynx 2.0 Data Transfer for Windows & DOS

FastLynx is two programs for the price of one! High speed data transfer between computers up to 8 meg per minute and remote computer disk drive and printer sharing. FastLynx is accurate and easy to use. Just connect two PC's with the cables included to either the serial or parallel port; then, simply move data from one directory to another... via a Novell network, bypass the server for quick easy station-to-station transfers. **PC Magazine "Editors' Choice." Publisher: Rupp Corp. 1T2644**



\$99

Smartcom Exec 2.1

Smartcom Exec - Powerful communications software that combines terminal emulations, error-control protocols, and a text editor to meet the needs of virtually any user. Special modem control supports all popular PC modems. In a LAN environment, Smartcom Exec supports modem sharing on many popular asynchronous communications servers. To maximize communications flexibility, the program provides options for installation in one or more languages (English, Spanish, Italian, French, or German) and multi-language user documentation. The combination of popular terminal emulations, error-control file transfer protocols, a full-featured text editor, SCOPE scripting language, keyboard macros, mouse control, and many more features make Smartcom Exec the ideal communications package for business and home use. **Publisher: Hayes CMO291**



\$75

Bridge 7.0

The Way to Better Bridge

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\$35



★ ACT! for Windows

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Publisher: Aldus GR5383

\$199

XTree Gold 2.5

XTree Gold 2.5 allows you to manage files, directories, and hard disks effortlessly. It has a handy Undelete utility, and an enhanced application menu with autobuild. Integrated file compression supports ZIP and ARC to save disk space. Complete file viewers for most popular applications display files in their native format. Publisher: XTree Company UT1874 \$99.

XTree For Windows

XTree for Windows is the essential companion to Microsoft Windows. Instantly copy, delete, move, rename and view files and directories with a single keystroke or mouse click. Open and arrange multiple windows to simultaneously view and manage files - including graphics files - without having to run the application that created them. Over 50 popular programs are supported. File compression is easier too, supporting the industry-standard ZIP format for fast, compatible file compression. XTreeLink is now included in XTree for Windows at no extra charge. Publisher: XTree UT2784

\$42

386MAX* 6

Winner of 1991 PC Magazine Editors' Choice, the Byte Award of Merit, InfoWorld "Buyers Assurance Seal" and InfoWorld's "Top Scoring Memory Manager". 386MAX 6 is perfect for both the experienced and the novice user. A new graphical interface seamlessly integrates memory management with SmartMemory, a disk cache and a powerful system analyzer. After rebalancing maximum high 14.6 megabyte, 386MAX automatically optimizes and configures your system for the most conventional memory. Publisher: Qualitas Also available: BlueMAX 6 UT1673 \$79. 386MAX 6 UT1684

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UT1794	• Mac-In-Do	75	
Palm, Inc.			
BS6794	• Business Plan Toolkit 4.0	95	
PG Globe, Inc.			
BS1684	• e-Globe 5.0	40	
BS1844	• PC USA 2.0	29	
Peachtree Software			
PN0533	• Peachtree Basic Accounting 6.0	75	
Poirier			
BS2864	• PackNet 4.1	259	
Power Up Software			
BS1654	• Calendar Creator Plus 4.0	43	
Qualitas			
UT1794	• 386MAX 6	61	
Quarterdeck Office Systems			
BS10435	• DESQview 386 2.4	129	
BS10435	• DESQview 386 2.4	129	
Rupp Corp.			
UT1794	• FastLink 2.0	99	
Schneider Software			
BS19235	• BetterWorking Eight-In-One	32	
BS19235	• PFS:WinFlow	95	
Serimatic			
UT17235	• Norton Anti-Virus 1.0	85	
UT17235	• Norton Anti-Virus Advanced 6.01	115	
UT17235	• Norton Backup 2.0 for DOS	99	
UT17235	• Norton Backup 2.0 for Windows	115	
UT17235	• O&A 4.0	255	
UT17235	• O&A 4.0	255	
Target Systems			
FN0413	• M.T.O.B.R for Windows	135	
Timeliness			
UT17235	• TimeSheet Professional for Windows	129	
BS6814	• Timeliness 5	195	
Tool Technology Publishing			
UT17235	• CheckIt Plus	125	
Toucheanton			
UT1074	• CheckIt PLUS	105	
Traveling Software			
UT1724	• LapLink Pro 4.0	89	
Trilion			
UT17235	• CD/Session	99	
WorldPerfect Corp.			
UT05335	• WorldPerfect 5.1	269	
UT05335	• WorldPerfect 5.1 for Windows	255	
XTree Company			
UT1814	• XTree Gold 2.5	99	

LANGUAGES

Microsoft			
BS0433	• Borland C++ 3.1	329	
UT1664	• Object Vision 2.0 for Windows	105	
UT1664	• Object Vision 2.0 for Windows	105	
UT1664	• Turbo C++ for Windows	115	
Microsoft			
BS0433	• C/C++ Compiler	299	
UT1664	• QuickBasic 4.5	125	
UT1664	• Visual Basic	65	

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Publisher: Abracaduta
 IH0094

\$39

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Abracaduta
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Architecture

EN2694

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Abracaduta EN2684

\$35



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Bodyworks

Now you can explore the human body's systems, structures, and functions in fascinating interactive detail. Includes a special health section with information on first aid, general fitness, sports injuries, and common illness. Publisher: Software Marketing ED3034 \$19.



\$39

*WinFax PRO 3.0

WinFax PRO 3.0 makes it easy to send, receive, and manage faxes from within Windows. Since WinFax PRO installs just like a Windows printer, you can send faxes just as easily as you print documents... directly from Windows applications. Sophisticated document management tools let you categorize faxes using detailed descriptions, keywords, and archiving capabilities. Mark up faxes with powerful annotation tools. State-of-the-art OCR technology converts incoming faxes into editable files for your word processor or spreadsheet. WinFax includes Cover Your Fax, 50 useful and attractive fax cover sheets. Or use the new Cover page. Designer and create your own. Maintain Multiple phone books and create groups for easy broadcast faxing. Publisher: Declina Technology FX0154

\$75



Orbits

Orbits lets you explore the worlds of wonder in outer space. This interactive space simulator and solar system atlas features animation and 3-D graphics. Requires 512K RAM, EGA or VGA color graphics, and supports a mouse. Publisher: Software Marketing ED3044

\$39



ScreenExtender for WordPerfect

ScreenExtender 2.0, voted #1 WordPerfect Add-On by WordPerfect Magazine readers, solves the most frustrating problem in WordPerfect: the need to scroll the screen left and right while typing and editing. Select up to 164 characters per line and up to 60 rows of text to edit a page at a time. In addition, ScreenExtender eliminates the guesswork of what to expect at print time by showing bold, underline, italics, superscript, text, small, large, very large, extra large and others as you edit. Six display fonts are provided. Supports VGA (600x600), VGA, EGA, CGA, Hercules and Gas Plasma (640x400) graphics. Network versions available. Network 5-Pack WP3544 \$179. Network 20-Pack WP3554 \$169. Publisher: Stairway Software

Single user WP1883/5

\$59



*Presentation Task Force CGM clip art 4.0

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\$134

Leading Edge VGA Color System D3/5X Plus 386-20

The Leading Edge Super VGA system uses a 20 Mbit 81366EN chip, and has 2 MB of RAM, plus both 3.5" and 5.25" floppy drives and a 130 MB hard disk. It comes complete with a .30mm VGA color monitor, a full 101-key keyboard, and a mouse. Includes MS-DOS 5.0, BASIC, Microsoft Works for Windows and Windows 3.0, Virscan and the PRODIGY Service start-up kit. Manufacturer's 12-month On Site Warranty. Manufacturer: Leading Edge BN0900



\$1099

► **S U M M A R Y O F F E A T U R E S**

In alphabetical order by company

■ = YES □ = NO

Cabletron
Systems Inc.
**Multi Media
Access
Center-M8FNB**

Chipcom Corp.
**ONLine System
Concentrator**

Lannet Data
Communications
Inc.
MultiNet LET-36

Optical Data
Systems Inc.
ODS 295

SynOptics
Communications
Inc.
**LattisNet System
3000**

Ungermann-
Bass Inc.
Access/Dne

FDDI Concentrator Modules (continued)

Supports STP media	□	□	□	N/A	■	□
Shielded connection	N/A	N/A	N/A	N/A	■	N/A
Supports coax media	□	□	□	N/A	■	□
Supports single-mode fiber	□	■	■	N/A	□	■
Supports multimode fiber	■	■	■	N/A	■	■
Dual homing offered	■	■	■	N/A	■	■
Number of MAC controllers per card	1	None	4	N/A	3	1
Number of MAC controllers per hub	7	None	64	N/A	3	4
Support for PMF/SMT optional values	■	■	■	N/A	■	■
Optical bypass switch offered	■	□	■	N/A	■	■

Terminal Server Module

Manufacturer	Xyplex	Datality	Xyplex	ODS, Xyplex	Xyplex	Ungermann-Bass
Number of ports	16	16	16	16	16	8
Supports LAT protocol	■	■	■	■	■	■
Supports TCP/IP protocol	■	■	■	■	■	■
Port-level LEDs	■	□	□	■	■	□
Board-level LEDs	■	■	■	■	■	■

Protocol Analyzer

Manufacturer	Cabletron, Novell	N/A	N/A	Novell, ODS	Netmetrix, SynOptics	ProTools
RMON MIB support:						
Ethernet	■	□	N/A	■	■	■
FDDI	□	□	N/A	■	□	□
Token-Ring (through proprietary extensions)	□	□	N/A	■	□	□
Number of RMON MIB portions supported	7	None	N/A	6	9	9

Fault Tolerance

Redundant power supplies	■	■	■	■	■	■
Redundant hubs	■	■	□	■	■	■
Redundant connections to the desktop	■	■	■	■	□	□
Redundant management modules	□	■	■	■	■	□

Network Management

Works with HP OpenView	■	□	□	■	■	□
Works with SunNet Manager	■	■	□	■	■	□
Operates under DOS	■	□	□	■	■	□
Operates under OS/2	□	□	□	□	■	■
Operates under Unix	■	■	■	■	■	□

N/A—Not applicable. The product does not have this feature

CONTINUES



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NetBIOS/NetBEUI	•	•	•
NDIS Adapters	•		
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Compatibility and support comparison of leading peer-to-peer products.



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NETWORKING
Enterprise Hubs

► **S U M M A R Y O F F E A T U R E S**

In alphabetical order by company	Cabletron Systems Inc. Multi Media Access Center-M8FNB	Chipcom Corp. Online System Concentrator	LanNet Data Communications Inc. MultiNet LET-36	Optical Data Systems Inc. ODS 295	SynOptics Communications Inc. LattisNet System 3000	Ungermann-Bass Inc. Access/One
■ = YES □ = NO						

Manufacturers of Database Engines Used

Gupta Technologies	☐	☐	☐	☐	☐	☐
Ingres Corp.	☐	☒	☐	☐	☐	☐
Microsoft Corp.	☐	☐	☐	☐	☐	☒
Oracle Corp.	☐	☐	☐	☐	☐	☐
Sybase	☐	☐	☐	☐	☒	☒
Other manufacturers	Hewlett-Packard	None	Raima Corp.	Hewlett-Packard, Sun Microsystems	Raima Corp.	None

Reporting

By date and time	☒	☒	☒	☒	☒	☒
By error	☒	☒	☒	☒	☒	☒
By port	☒	☒	☒	☒	☒	☒
By protocol type	☒	☐	☐	☒	☒	☒
By MAC address	☒	☒	☒	☒	☒	☒
By network address	☒	☐	☒	☒	☒	☒
User can design a filter	☐	☒	☒	☒	☒	☒
User can specify a range	☐	☒	☒	☒	☒	☒

Security

Blocks traffic from unnecessary ports	☐	☐	☐	☒	☐	☐
Restricts access to a specific port	☒	☒	☐	☒	☒	☐

Network Management Gateways Supported

Accumaster	☒	☐	☒ (via SNMP)	☐	☐	☒ (via SNMP)
DEC EMCC	☐	☐	☒ (via SNMP)	☐	☒	☒ (via SNMP)
NetView	☒	☒	☒	☒	☒	☒

Alarm Filtering

By date and time	☒	☒	☒	☒	☐	☒
By error	☒	☒	☒	☒	☒	☒
By MAC address	☒	☒	☐	☒	☒	☒
By network address	☒	☐	☐	☒	☒	☒
By port	☒	☒	☒	☒	☒	☐
By protocol type	☒	☐	☐	☒	☒	☒
User can design filter	☒	☒	☒	☒	☒	☒
User can specify range	☒	☒	☒	☒	☒	☒

Selected Company Affiliations

ACC Systems	None	None	None	None	None	Manufactures routers and bridges
BBN Communications	None	None	None	None	None	Reseller and developer

CONTINUES

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READERS
CHOICE
1992

PC
MAGAZINE
EDITORS'
CHOICE
April 14, 1992
LANtastic, Version 4.0

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CIRCLE 254 ON READER SERVICE CARD

► **S U M M A R Y O F F E A T U R E S**

In alphabetical order by company

■ = YES □ = NO

Cabletron
Systems Inc.
**Multi Media
Access
Center-M8FNB**

Chipcom Corp.
**ONLine System
Concentrator**

Lannet Data
Communications
Inc.
MultiNet LET-36

Optical Data
Systems Inc.
ODS 295

SynOptics
Communications
Inc.
**LattisNet System
3000**

Ungermann-
Bass Inc.
Access/One

Selected Company Affiliations (continued)

British Telecom	None	None	None	None	None	Reseller and developer
Cayman Systems	Manufactures Local-Talk module and network management	None	None	None	None	None
Cisco Systems	Manufactures routers	Manufactures routers	None	Manufactures file servers, bridges, and routers	Manufactures routers	None
Digital Equipment Corp.	None	Distributes products	Manufactures network management	Manufactures routers	Manufactures network management	Licenses LAT protocol for terminal servers
Farallon Computing Corp.	None	None	None	None	Manufactures Apple-Talk modules	None
Hewlett-Packard Co.	Manufactures network management	None	Manufactures network management	Manufactures network management	Manufactures network management	None
IBM Corp.	Resells products	Joint marketing agreement	None	Manufactures network adapters	Shares technology	Shares technology
Microsoft Corp.	None	None	None	None	None	Shares technology
Motorola Corp.	None	None	Manufactures chips	None	None	Manufactures wireless LAN products
NCI	None	None	None	Manufactures network adapters and bridges	None	None
NetWorth	None	None	None	None	None	Owned by Ungermann-Bass
Novell	Manufactures protocol analyzers	Shares technology	None	Manufactures protocol analyzers	Shares technology	Shares technology
Retix Corp.	None	None	None	None	Manufactures bridges	None
Sun Microsystems	Resells products, manufactures network management	Manufactures network management	Manufactures network management	Manufactures network management	Manufactures network management	None
3Com Corp.	None	None	None	Manufactures LocalTalk bridge modules	None	None
Wellfleet Communications	Resells products, manufactures network management	None	None	None	None	Manufactures routers
Xyplex	Manufactures terminal servers	None	Manufactures terminal servers	Manufactures routers, terminal servers	Manufactures terminal servers	None

ENDS

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"CorelDRAW remains the easiest-to-use graphics product on the market...the ultimate graphics bargain!"

PC Magazine, August, 1992

"CorelDRAW — ALL THAT MOST PEOPLE WILL EVER WANT in the way of a graphics software..."

William D. Harrel, Windows Magazine, July, 1992

"Business users who need a wide variety of graphics functions shouldn't pass up this package. It is an amazing bargain."

Luisa Simone, PC Magazine, August, 1992

"Endowed with paint, chart and presentation capabilities, this upgrade of the leading PC draw package is a stunning example of increased power at a reduced price."

Christina Wood, PC WORLD, July, 1992

"It's hard to find a more value-laden offering. We rate the value as excellent."

Mike Heck, INFOWORLD, July 13, 1992

"Total relative value of CorelDRAW modules, clipart and fonts is \$15,000."

John Butler, Seybold Report on Desktop Publishing, July, 1992

"CorelDRAW is a phenomenal bargain."

Michael Burgard, PC/Computing, July, 1992

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"CorelDRAW 3.0 is without doubt the most powerful, feature-laden, and best value for money graphics systems for Windows, at any price point. Full stop, end of discussion."

Jon Honeyball, Windows Magazine UK, August, 1992

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Micrografx	Designer	Chartwiz	Picture Publisher	251	9940	\$1685
Software Publishing Corporation	Harvard Draw	Harvard Graphics (Windows)	Not Available	62	1600	\$1190
Aldus	Freehand	Persuasion	PhotoStyler	12	305	\$1885
Corel	CorelDRAW [®]	CorelDRAW [®]	CorelDRAW [®]	256	14,000	\$595

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Cabletron Systems Inc.

Multi Media Access Center-M8FNB

BY JEFFREY L. CARRELL

Cabletron Systems provides a high-powered combination of products. The flexible design of its MMAC (Multi Media Access Center) wiring hub series and Spectrum, its high-end network-management product, gives you access to all major LAN topologies, plus wide-area network connectivity, fault tolerance, and manageability of all your networking products. Spectrum is expensive and lacks some features, so Cabletron also offers less expensive alternatives.

We chose to test the eight-slot Multi Media Access Center-M8FNB (MMAC-M8FNB) and installed EMME, Cabletron's Ethernet bridging management module and TRMM, the company's Token-Ring management module, inside it. We also tested the TPMM-24, Cabletron's 24-port 10BaseT Ethernet media-interface module; EFDMM, the company's Ethernet-to-FDDI bridging module; TPRMM-36, its 24-port 10BaseT repeater interface module; TRMIM-24A, its 24-port active Token-Ring media interface module; and the CRM-L, a router module from Cisco Systems. FDDI support is currently limited to the EFDMM bridge.

Cabletron gives you many choices. But if you have a mixed-topology MMAC (Ethernet and Token-Ring), you won't be able to install both management modules in the same hub. You can manage Ethernet and Token-Ring segments on the same network, but because the hub has only one half-width slot for management modules, you can't manage them both from the same hub. Cabletron plans to provide full-slot management modules soon.

The MMAC line's dynamically self-configurable FNB (Flexible Network Bus) design lets you vary the number of Ethernet and Token-Ring connections, as long as you don't exceed the total. Cabletron's Integrated Network Architecture (INA) concept ties together the networks.

Cabletron combines good results on our performance tests with a well-rounded product selection, including a

three-slot chassis, terminal servers, standalone Ethernet hubs, various external transceivers, PC and Macintosh network interface cards, and a LocalTalk-to-Ethernet bridge built by Cayman Systems. And unlike most vendors, Cabletron offers an integrated network-monitoring module based on Novell's LANtorn protocol analyzer board.

FLEXIBLE DESIGN

The MMAC chassis comes in three sizes: three-, five-, and eight-slot. Although some vendors offer you more slots, Cabletron compensates by providing some double-capacity modules. Many of Cabletron's modules offer multiple features: its Ethernet modules can perform repeater, management, and bridging functions for two segments. Its Token-Ring module combines management and Token-Ring bridging. Cabletron's modules support almost all connector types for Ethernet, FDDI, LocalTalk, and Token-Ring networks.

Each of Cabletron's three chassis are available with or without the FNB design. The bus handles a bandwidth of 650 megabits per second. Cabletron's five- and eight-slot FNB chassis let you install multiple power supplies for load sharing and power redundancy.

SPECTRUM OF MANAGEMENT CHOICES

To monitor all these modules, Cabletron offers several options. Spectrum is a Unix-based network-management platform that does not require another management program. Remote LANView/Windows is a DOS-based network-management platform that requires HP OpenView. You can also access network-management features via serial console connection.

Many of the modules Cabletron sells also contain extra monitoring functionality. The bridge and router modules, for example, provide information on packet-forwarding rates. Cabletron's hub doesn't provide a bus with a separate connector for network management, but traces on the bus can be used to manage the network.

All of the network management prod-

ucts use SNMP. You can manage Cabletron products down to the port level of any module and manage any third-party products based on SNMP.

Spectrum, Cabletron's flagship network-management station, is robust and extensive. Once designed to function as a "manager of managers", similar to IBM's NetView, Spectrum is now more in line with element managers such as Sun Microsystems' SunNet Manager.

The system displays data in graphical and text-based formats. You start by building enterprisewide diagrams, feeding Spectrum information from the primary SNMP devices. You can view chassis-level information showing all of the installed modules and their status, as well



Cabletron's Unix-based Spectrum is a heavy-duty management system that lets you administer Cabletron and third-party products across an enterprise network.

as module-level status diagrams. You can diagnose down to the module's port level. Security is controlled mostly through Unix, and you can set up functional password levels for users of Spectrum.

Spectrum suffers from some important problems, however. First, it costs about \$20,000 for the main functions, and the price can easily climb higher. Second, there is no built-in SQL (structured query language) database support, so you cannot perform ad-hoc queries on the data without using a third-party SQL-based system. Third, there is no on-line help.

Our review testing revealed another problem. Both Spectrum and Remote LANView failed to perform dynamic screen updates when we removed modules and inserted them in different slots. We had to close the windows and reopen

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**Corporate Series
486 DX 33**



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- 4 MB RAM
(Expandable to 64MB)
- Zero Wait State
- 64 KB Secondary High Speed Cache Memory
- 120 MB (19 ms) Hard Drive
- 3.5" 1.44 MB FDD
- 14" 28 mm Dot Pitch 1024 x 768 Ultra-High Resolution Flicker-Free Display (70 Hz Refresh)
- 2 Serial, 1 Parallel I/O ports
- DOS 5.0
- Windows 3.1
- Mouse
- Upgradable Processor Architecture Allows for Easy Upgrade to Next Generation Processor



**Corporate Series
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- DOS 5.0
- FastLynx
- Memory Expandable
- One Dedicated Internal Modem Slot



Super 386 SX 25

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them to display the new configuration. Cabletron admits that not all parts of its system can perform dynamic updating.

In addition, you cannot build an alias list or file of the network's media access control addresses, making troubleshooting shooting more difficult. In contrast, the find feature on SynOptics' LattisNet System 3000 product lets you easily locate the network devices.

Cabletron's network management on the DOS platform is fairly close to the Unix version of the product. The screens on both platforms are almost identical, with approximately the same feature set. You sacrifice some speed when you go out of band, however. The program's management tools let you

view all the modules and their status, activities, errors, link conditions, and types of connections.

To help you understand its system, Cabletron provides more extensive documentation than any other hub manufacturer, particularly on using Spectrum to manage third-party products. But not all manuals contain an index, and anytime you need to use a Unix command, you have to consult the package's accompanying Unix manuals.

Cabletron's standard warranty lasts 90 days. Out-of-warranty, on-site, and resident engineer programs are also available. The company provides phone support free for all customers, and toll-free phone support for customers enrolled in its services program.

Cabletron's INA strategy has clearly met the objective of providing a manageable enterprisewide system. The MMAC product suite contains all the major components necessary to build a reliable, fault-tolerant system.

Chipcom Corp.

ONline System Concentrator

BY JEFFREY L. CARRELL
AND PADRAIC R. BOYLE

If you require redundancy and flexibility in your network, Chipcom Corp.'s line of ONline System Concentrators may be the solution for you. Although Chipcom does not offer as many products as Cabletron Systems or SynOptics Communications, its TriChannel Architecture gives you some unusual functionality.

Having signed a recent licensing agreement with IBM, Chipcom is a company on the rise. We tested the 17-slot version of the company's ONline System Concentrator. Chipcom also offers a six-slot version. Both are basically the same except for their size and slot capacity. Chipcom provides mod-

ules that have as many as 20 ports, depending on the media type. The company sells many Ethernet and Token-Ring modules, as well as a terminal-server module and an Ethernet router module (in a joint venture with Cisco Systems). Connector types for Ethernet, FDDI, Token-Ring, and terminal-server modules are available. Chipcom emphasizes fault tolerance in its ONline family, and sells redundant power supplies and connections plus backup concentrators and transceivers.

The ONline System Concentrator did respectably well in our tests, scoring mostly in the midrange in throughput and latency. With our largest packets, it tied with the Multi Media Access Center-M8FNB and ODS 295 for the best throughput.

Despite the performance and versatility of Chipcom's product line, there are some limitations. Some of Chipcom's products lack support for standard connector platforms, and the 50-pin Telco connectors on the terminal server and on the Ethernet module get in the way when you want to remove or replace modules next to them. Some equipment we received for testing contained extra-long component and connector pins on the back and jumpers around the circuitry. They looked more like early production units than finished hardware.

The chassis design itself is unique; the passive backplane contains only a single 96-pin connector and can accommodate up to two gigabits of total bandwidth. Few products offer users as much. This equates to a maximum of either three

SUITABILITY TO TASK

Multi Media Access Center-M8FNB

	POOR	FAIR	GOOD	EXCELLENT
Management	●	●	○	○
Troubleshooting	●	●	●	○
Expandability	●	●	○	○
Fault tolerance	●	●	●	○
Bridging and routing	●	●	●	●

FACT FILE

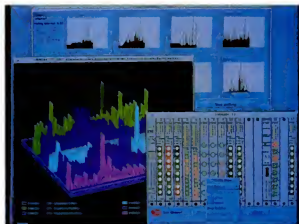
Multi Media Access Center-M8FNB (MMAC-M8FNB)

Cabletron Systems Inc., 35 Industrial Way,
Box 5005, Rochester, NH 03867-0505;
603-332-9400; fax, 603-332-4616.

List price: MMAC-3FNB (3-slot chassis), \$1,250; MMAC-5FNB (5-slot chassis), \$1,550; MMAC-M8FNB (8-slot chassis), \$1,850. MMAC-9PSM (power supply module), \$1,380; IRM-3 (Enhanced Ethernet repeater with SNMP), \$6,500; EMME (Ethernet bridging management module), \$7,995; TPMIM-24 (24-port 10BaseT Ethernet media-interface module), \$3,795; TPMIM-38 (24-port 10BaseT repeater interface module), \$3,995; TRIMM (Token-Ring management module), \$4,995; TRIMM-24A (24-port active Token-Ring media interface module), \$3,795; TRIMF-2 (Token-Ring media filter), \$59; CRM-4 (Ethernet local router module), \$5,945; EFDMM (Ethernet-to-FDDI bridging module), \$19,995. Remote LANview/Windows (DOS-based network management software package), \$4,995; Spectrum (Unix-based network management software package), \$20,000 or higher, depending on functions chosen.

In short: The Cabletron MMAC-M8FNB provides flexible design and a powerful but expensive management system called Spectrum that you can also use to manage third-party products throughout your network. It had the best overall results in our bridge performance tests.

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The ONdemand Network Control System (NCS), Chipcom's graphical network management package, works with SunNet Manager. It can generate two- and three-dimensional bar charts of statistics such as the number of frames received.



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Ethernet networks, four FDDI networks, or seven Token-Ring networks. The backplane provides a single connector that can support up to three types of networks—Ethernet, FDDI, and Token-Ring—simultaneously along the system's three data channels. There are dedicated traces for the network management bus, as with other hubs, but no dedicated connectors.

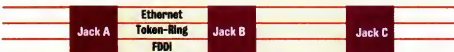
The base configuration of the hub consists of a built-in power supply, and a clocking module if the hub is connected to an Ethernet network. Unlike the LattisNet System 3000, the ONline System Concentrator does not require a separate slot for its power supply. Otherwise, all of its slots are identical to those of the System 3000 and all modules can be hot-swapped. All of the modules send their IDs across the bus at the MAC layer. Other hub products generally send

A Look at the Bus Options

Hub vendors provide different types of buses for connecting the modules that plug into their hubs. The segmented bus (A) is one bus divided into multiple segments, each carrying Ethernet, FDDI, or Token-Ring. Some vendors offer multiple buses (B), each bus carrying only Ethernet, FDDI, or Token-Ring signals. The third bus architecture, the multiplexed bus (C), uses special techniques to divide one physical bus

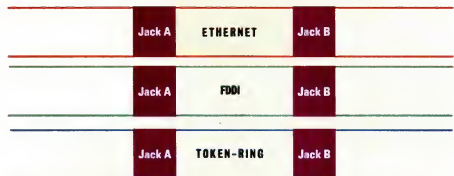
into multiple virtual buses. Each virtual bus carries Ethernet, FDDI, or Token-Ring traffic, with modules connecting to any of the appropriate buses. In the fourth option, the system bus functions as an EISA, ISA, or MCA bus. This enables modules to transfer any kind of data over one bus. A module uses interrupts to gain control of the bus and then directs data to a module's address.

A Segmented bus



Modules plug into jack A, B, or C and automatically sense whether or not the segment is free. If the segment is free, the module can connect with an adjoining module. If the segment is not free, the module can either join the network or try another segment. In this fashion, Ethernet, FDDI, and Token-Ring modules can use the same bus.

B Multiple buses



Each bus carries a separate kind of signal, either Ethernet, FDDI, or Token-Ring. Only modules that use that particular access method can plug into the bus.

C Multiplexed bus



As opposed to a bus divided into multiple segments, the multiplexed bus uses special techniques to create multiple virtual buses.

D System bus

ETHERNET/FDDI/TOKEN-RING

Jack A

Jack B

Jack C

The system bus functions like the EISA, ISA, or MCA bus of a PC. A module gains control of the bus, addresses another module, and then transfers any type of data across the bus to that module.

FACT FILE

Online System Concentrator

Chipcom Corp., 118 Turnpike Rd.,
Southborough, MA 01772; 508-460-8900;
800-228-9930; fax, 508-485-5335.

List price: 6-slot chassis, \$1,695; 17-slot chassis, \$4,250. 510PS-325 (power supply module), \$950; 5102M-AUIF (2-port Ethernet repeater module), \$1,500; 5112M-TPPL (12-port Ethernet module with port switching), \$1,995; 5116M-TS-TL (16-port Ethernet terminal server module with TCP/IP and LAT support), \$3,995; 5102B-EE (2-port Ethernet bridge module), \$4,250; 5102R-EE (2-port Ethernet router module), \$6,350; 5100M-MGT (Basic Ethernet SNMP management control module), \$2,950. 5220M (8-port Token-Ring twisted-pair media module), \$1,195; 5220M-TP (20-port Token-Ring media module), \$2,150; 5202M-FR (4-port Token-Ring fiber-repeater module), \$2,800; 5308M-FIB-ST (8-port FDDI-fiber module), \$13,500. ONline Network Control System (SCD Unix-based network management software), \$6,500–\$12,500 (depending on number of concentrators); ONdemand Network Control System (SunNet Manager-based network management software), \$1,995–\$3,800 (depending on number of concentrators).

In short: The Online System Concentrator features a TriChannel Architecture that lets you swap ports and modules through the software without touching the modules, and a programmable facility in its ONline NCS and ONdemand NCS software that allows the system to change its own configuration at specified times.

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their IDs across the dedicated management traces.

MANAGEMENT ALTERNATIVES

Chipcom offers two management programs for its hubs: ONdemand Network Control System (NCS) and ONline NCS. Both are Unix-based but use different Unix operating systems.

ONdemand NCS, like SynOptics' LattisNet for Unix, requires SunNet Manager open-systems Unix platforms and can run on a Sun SPARCstation. Prices range from \$1,995 to \$3,800, depending on the number of concentrators. The open-system architecture allows you to access the ONline System Concentrator's hardware as well as other SNMP-compatible systems from the same platform. You can use a graphical map to navigate around the system easily. The product provides in-band management, along with a serial connection using Serial Line Interface Protocol (SLIP) on the management modules. You can manage the hubs either through the hub's TCP/IP (Transmission Control Protocol/Internet Protocol) number assignments or by using a logical name for the hub. You can also use Unix's Telnet utility to access the management modules, but you must use a cryptic command line interface if your primary Unix console is unavailable.

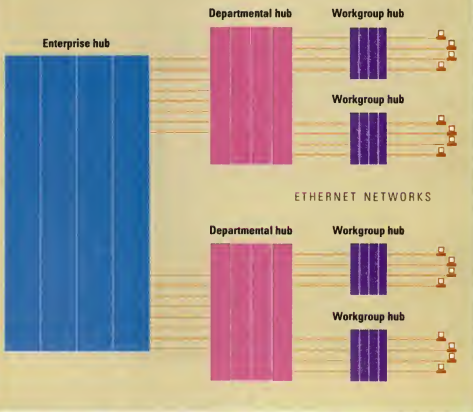
ONline NCS runs on Santa Cruz Operations' Open Desktop and utilizes Ingres Corp.'s SQL database. Prices for ONline range from \$6,500 to \$12,500, depending on the number of concentrators. ONline NCS provides many of the same capabilities as ONdemand NCS but cannot monitor Chipcom's FDDI module. You must use Telnet at the command line to get support for other companies' SNMP hardware. ONline NCS does not use any management information bases or graphics, and the SNMP portion must exist on the device that is being managed.

You can use either ONline NCS or ONdemand NCS in conjunction with Chipcom's TriChannel Architecture technology to swap ports and modules

Software-Reconfigurable Networks: Fact or Fantasy?

You can build a network today that can be reconfigured through software, but it demands a complex wiring scheme that gives each network station its own path to the enterprise hub.

You will need to run a separate cable between hubs for each network within the central enterprise hub. The central hub will need the ability to connect dozens if not hundreds of networks.



through the software without physically changing your network configuration. From the network management station, you can change a module's configuration logically to reflect a move of one or a group of user connections without physically moving any of the modules. The on-

screen display, although not completely graphical, tells you whether the moves are successful. This can be a useful feature in case you need to balance the network load because of excessive traffic. You can also isolate ports from the

network to run diagnostics. You can only move individual ports for users on Ethernet networks, however.

The ONline System Concentrator also gives you the ability to write external programs to perform triggered tasks. You

can use this feature to take advantage of the device's TriChannel Architecture and port-swapping technology. If you have a group of client PCs that upload data across the network at a specific time, you can automatically have the hub switch their connections into a separate Ethernet segment.

The ONline System Concentrator's security features encompass several layers of password protection. If an unauthorized user attempts to access the network, it sends out an alarm to the central management station. The administrator can configure the software to remove the intruder's port automatically.

Chipcom's documentation is among the best we've seen. Each product component comes with an easy-to-read manual that includes a table of contents and an index. The only minor drawback is that some manuals contain release notes printed on larger paper that does not fit into the binders. Chipcom also does not provide enough binders to hold a com-

SUITABILITY TO TASK				
ONline System Concentrator				
	POOR	FAIR	GOOD	EXCELLENT
Management	●	●	●	○
Troubleshooting	●	●	●	○
Expandability	●	●	●	○
Fault tolerance	●	●	●	○
Bridging and routing	●	●	○	○

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*PC Magazine, Service and Reliability Survey - September 11, 1990
Government Computer News, Product Preference Survey - January 20, 1992

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• **Engineered and Built Right Here At Swan** -- Our new 'V'Line systems are assembled by the same technicians, in the same quality-oriented environment as our other Swan systems, so you get reliability you can bank on.

• **Custom Configurations** -- Our competition offers a "take it, or leave it" low cost system -- not Swan! You get the freedom to design your system to suit your specific needs!

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plete set of documentation for every module.

Chipcom provides a one-year warranty covering parts and labor and, as an option, on-site service. Toll-free phone support is available to all customers.

Chipcom's products offer some distinct features and capabilities. While there are some rough edges, most of the problems we saw are minor. With its many management features, module types, redundancy, and flexibility, the Chipcom product family can provide a high level of uptime for any LAN.

Lannet Data Communications Inc.

MultiNet LET-36

BY JEFFREY L. CARRELL

Lannet Data Communications has taken an unusual step. One of the first vendors to announce a hub designed to run multimedia applications, Lannet has backed up its move with a solid set of Ethernet and Token-Ring modules.

But despite the glamour of multimedia, Lannet's MultiNet LET-36 wiring hub has a long way to go before it can offer top-notch network management. Missing features, poorly designed management software, and convoluted documentation make the LET-36 difficult to administer.

Lannet recently inked an agreement with Starlight Networks to create a hub that provides such multimedia applications as video conferencing across the network. The key to the product's success will be protocol software, provided by Starlight, to handle the network messages. Lannet's switch technology will enable multiple Ethernet channels to carry the traffic.

The product isn't expected to ship until early next year. Until then, you'll have to be satisfied with Lannet's external transceiver offerings and PC-based network interface cards, and its flagship product, the LET series of wiring hubs. These include the LET-3, a 3-slot modular hub; the LET-18, an 18-slot modular

hub; and the LET-36, the 36-slot wiring hub we tested for this feature.

Three buses anchor the LET-36. A dual 96-line bus connects the modules and allows up to four Ethernet and 18 Token-Ring networks. A high-speed bus is designed for the upcoming multimedia-over-Ethernet application and is already in use on some customers' networks. Lannet also offers an FDDI (Fiber Distributed Data Interface) concentrator module for its hub.

The control bus built into each 96-line bus is a disappointment. Because there are only four address lines with which to monitor modules, it can address only 16 slots on any 18-slot bus. Since the LET-36 is a dual 18-slot hub, it does not let the network management module manage four of the hub's 36 slots.

MODULES FOR ALL OCCASIONS

Unlike the other vendors in this review, Lannet offers two module sizes. The smaller hubs' modules are 5.25 inches high, while the LET-36's can also be 10.5 inches. A mechanical divider lets the LET-36 accept either module size.

Lannet offers an impressive array of modules, including a terminal server and Ethernet-to-Ethernet and Token-Ring-to-Token-Ring bridge modules. But Lannet lacks a router that would provide

critical internetworking capability. Lannet provides fiber connectors for its Ethernet module, but the module supports only multimode fiber.

The company also offers synchronous Ethernet modules. Synchronous Ethernet, part of the upcoming Ethernet-over-Fiber (10BaseF) standard, establishes synchronous links between wiring hubs. This provides real-time redundancy, extensive diagnostics, better immunity from noise, and more reliable transmissions than with other Ethernet specifications.

The LET-36 offers more redundant ports and connections than most of the other review products, letting you configure more modules as back up ports.

Lannet also offers Ethernet and Token-Ring concentrator modules for virtu-

ally every media type. Bityx Corp. (whose products are not reviewed here), Chipcom Corp. and Lannet are the only vendors that let you use software to switch ports between networks. With these vendors' products, you can reconfigure your LAN with the click of a mouse from your management station.

Lannet has also incorporated Ethernet clocking circuitry on the backplane, saving you a module slot. If you need to locate faults, you'll like Lannet's 10BaseT-Plus, a feature that enables you to detect a network problem quickly by examining receive and transmit signals.

Separate network-management modules are available for Ethernet and Token-Ring. Both can gather statistics from concentrator modules using the same LAN, but are limited to controlling the

FACT FILE

MultiNet LET-36

Lannet Data Communications Inc., 7711 Center Ave., #600, Huntington Beach, CA 92647; 714-891-5580; fax, 714-891-7788.

List price: LET-3 (3-slot chassis, \$900), LET-18 (18-slot chassis, \$2,000), LET-36 (36-slot chassis, \$4,320). BUPS-36/115 (power supply), \$795; NMA-36/20 (SNMP management module), \$2,950; LE-20N (2-port 10BaseF fiber module), \$995; LE-80XT (8-port 10BaseT module), \$1,195; LE-140XT (10-port 10BaseT module), \$1,795; LE-10B2N (2-port thin coax repeater module), \$675; LTS-16/LT (16-port Ethernet terminal server module with TCP/IP and LAT), \$3,995; IE1B (Ethernet local bridge), \$3,195; LTR-10/D9 (Token-Ring STP Ring In/Dut module), \$295; LTR-T/RJ45 (Token-Ring UTP repeater module), \$900; LTR-F/16 (Token-Ring fiber repeater module), \$1,495; LTR-4/RJ45 (4-port UTP Token-Ring lobe module), \$395; LTR-4/D9 (4-port STP lobe module), \$395; LTR-104 (10-port Token-Ring UTP module), \$795; ITLB (Token-Ring local bridge), \$3,995. MultiMan (Unix-based management software), \$5,995.

In short: Lannet's MultiNet LET-36 has the most slots of any hub reviewed here, 36 in all. It includes advanced features such as support for synchronous Ethernet over fiber, enhanced 10BaseT, redundant connections, a powerful SQL database, and also holds the promise of future multimedia capabilities. But despite its many slots, the hub is limited in its current FDDI support and in the number of modules it can address. The MultiMan control software provides the wrong information for some slots, but it does let you move modules without physically touching the hub.



ON-READER SERVICE CARD

ports on the concentrator modules of a different topology. The Ethernet network-management module can control Token-Ring modules and ports, for example, but cannot get their statistics.

One important obstacle to configuring these modules is the lack of an alias file (a list of mappings of hardware physical addresses to logical names, used for troubleshooting) for tracking the MAC (media-access control) layer addresses of the devices on the network. Before you can manage the SNMP module, you must physically attach a terminal to each module on the console port and program in its IP (Internet Protocol) address. Lannet should provide a BOOTP or RARP (Remote Address Routing Protocol) server utility to download information automatically, as SynOptics Communications does for its devices.

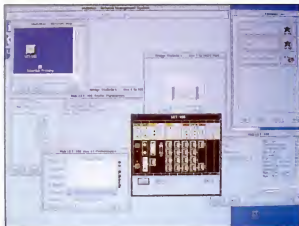
PEERING INTO THE HUB

The LET-36 relies on MultiMan software for its SNMP management console. MultiMan runs on a Sun SPARCstation under SunOS and provides in-band and

out-of-band management using Serial Line Interface Protocol (SLIP) over a serial link.

Unlike most of the management offerings from the other vendors, MultiMan does not support either HP OpenView or SunNet Manager. This may make it more difficult to integrate network devices from other vendors into the LET-36's management platform. Lannet does plan to add HP OpenView support during the first half of next year, however.

MultiMan and Ungermann-Bass's NetDirector are among the few network management stations whose architecture is based on a powerful SQL (structured query language) database. With this type of architecture, you can perform freehand queries rather than pick options off the menu. The feature is rather cryptic, however, and is likely to require consulting the manual at least occasionally for assistance.



Lannet's MultiMan network management system can give you an overview of various types of network activity by simultaneously displaying on-screen information about those activities.

MAPPING THE NETWORK

MultiMan keeps pace with competing solutions by letting you build a map of your network. In navigating through the various devices, you call up detailed displays at the board or module level. Fault, event, and threshold alarms appear on-screen.

The LET-36's 4-bit control bus does

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not always allow the modules to be updated on-screen, however. MultiMan always displays modules in slots 17, 18, 35, and 36, even if none are actually installed. This problem should be fixed once Lannet updates its 4-bit bus.

Unfortunately, you cannot display a single port by itself, nor can you distinguish the type of media connected to any given port. You can distinguish some connector types, but some of the information is not legible unless you navigate further down for a more detailed view.

Under heavy network usage, the network-management console's speed and functionality are limited. When we loaded down the network with traffic, the console either locked up or responded so slowly that the simplest alerts took many minutes to appear.

Configuration management is available, but only as far down as the module level. You can move modules from one network to another from the console, and you can take advantage of some of a module's built-in redundancy. For example, you can set an Ethernet module to switch to another network in case its current network fails. A few modules, mainly bridge and management modules, also offer this feature at the port level.

The product's documentation is not easy for inexperienced users to understand. On-line help is available but cannot be customized. The company provides 12 months of end-user support for its hardware products and three months for software.

The MultiNet LET-36 has many commendable capabilities. But the features that are either missing or not fully implemented may make Lannet's hubs cumbersome to maintain in a large installation.

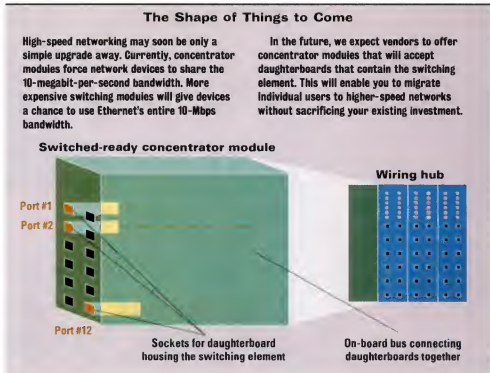
Optical Data Systems Inc.

ODS 295

BY PADRAIC R. BOYLE

The bargain among enterprise wiring hubs is the ODS 295 from Optical Data Systems (ODS). The ODS 295 costs only half as much as solutions from SynOptics Communications or Ungermann-Bass, and it is the only product reviewed that offers a PC inside the hub.

There are drawbacks, naturally.



FDDI support could be better, as could network management. But overall, the 295 is a solid buy for the cost-conscious customer.

A pioneer in fiber-optic wiring hubs, ODS introduced the first line of Ethernet fiber-optic transceivers and workgroup hubs in 1987, and was one of the first companies to run Token-Ring over fiber-optic cabling. These innovations proved successful—last year ODS rang up \$37 million in revenue.

We wanted to look at ODS's new premier hub, the 1090. Unfortunately, the Ethernet and Token-Ring modules are

ble option or a drawback.

The 295 and 296 share the same Token-Ring backplane design. With the flip of an internal switch, you can have three separate Token-Ring backplanes on the bottom, with four slots each. You can partition them into three networks, or into one 4-slot and one 8-slot network, or one 12-slot network. In addition to the three internal networks, you can partition each module from the backplane to configure up to 12 individual networks in one chassis, giving you more flexibility in your Token-Ring network.

Neither the 295 nor 296 offers you a separate management bus. They each deliver management data and network traffic across the same bus, and thus may be adversely affected by heavy traffic.

SUITABILITY TO TASK

ODS 295

	POOR	FAIR	GOOD	EXCELLENT
Management	●	●	○	○
Troubleshooting	●	●	●	○
Expandability	●	●	○	○
Fault tolerance	●	●	●	○
Bridging and routing	●	●	○	○

Like the ODS 296, its sister hub, the ODS 295 offers two physical buses: Ethernet at

the top and Token-Ring on the bottom. But whereas the 295 has one bus for Ethernet, the 296 breaks the Ethernet bus into three separate sections, taking up four slots each. In effect, the 296 gives you three independent Ethernet segments on one hub. Depending upon your network design, this can be either a usa-

GRAMMING THE FILE SERVER INTO THE HUB

Unlike its competitors, ODS's modules suffer from two major problems. First, they aren't hot-swappable. If you have to replace a module, the hub must be taken down. Second, some modules are slot-specific, so you'll be limited in how you can populate the wiring hub.

The Token-Ring and Ethernet con-



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CIRCLE 139 ON READER SERVICE CARD

centrator modules both support a wide variety of media. Bridging and routing are available for both types of networks.

Though the 295 and 296 lack FDDI concentrator modules of their own, you can use their 386 Connection Server module to create an FDDI router. The Connection Server is a 20-MHz 80386 server module that can route or bridge between any two networks. Various configurations are available; the high-end configuration supplies a 120MB IDE (integrated development environment) hard disk and 10MB of RAM.

The Connection Server should supply you with greater flexibility, but swapping network adapters can be a frustrating experience. For example, ODS supplied us with Token-Ring and FDDI adapters routed together via NetWare running on the server module. When we swapped the ODS-supplied Olicom Token-Ring

card and an FDDI card with two Ethernet cards, the 386 Connection Server module failed to operate. We tried resetting the 386 module several times, but it wouldn't work. In fact, ODS itself could not get the product to work.

If there's a drawback to the Connection Server, it's in the number of slots required in the hub: It requires two slots and the network connections take one additional slot.

MANAGING THE HUB

To manage these Token-Ring and Ethernet segments, you need a separate management module for each type of segment. The Token-Ring management module takes up two valuable hub slots. The Ethernet module uses one slot.

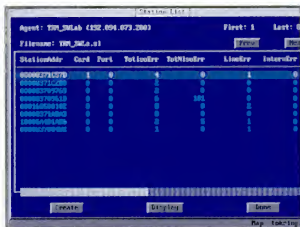
The Token-Ring management module controls the configuration of the Token-Ring modules and also manages them with SNMP. LEDs on the front of each Token-Ring module indicate the status of each port.

The Ethernet management module performs several tasks, from SNMP management to retiming and repeating of the network signal between hubs. An onboard RISC processor handles packet analysis and statistical data and delivers it back to the centralized management station. LEDs on the front of the Ethernet management module give information about its status.

LanVision monitors the hub by interrogating the management modules. Unlike solutions from most of the other vendors in this review, LanVision is a standalone DOS application that does not run under Sun's SunNet Manager or HP OpenView.

LanVision provides a topology map that uses icons to represent the hubs and their locations. It implements pull-down menus to allow you to manage SNMP and its alarms. LanVision also allows you to add, delete, and configure your network topology.

You can control individual ports and set thresholds to monitor events by port or module. If a failure occurs or a threshold is exceeded, LanVision will notify you through visual and audible alarms.



ODS's LanVision is a DOS-based network management package that uses pull-down menus to give you statistical information, such as line errors for various stations.

You can configure these alarms for each network device. This option offers the ability to set a user-defined response to an exceeded threshold. If, for example, an Ethernet port is transmitting short frames and a threshold is exceeded, you can configure the port to shut off automatically and send back an alarm to the management station.

Graphical representation of statistics is available in real time. You can monitor up to five different SNMP agents concurrently. These statistics can be displayed as a histogram with differently colored lines for each monitored agent. These graphs are not particularly clear when you're monitoring more than two agents at a time, however.

Security is always an issue in wide-area networking. LanVision provides multilevel security to prevent unauthorized access to the concentrators. By using ODS's own SNMP agents, you can prevent any new devices or changed addresses from entering the network. You can use these two agents to secure a network from unauthorized personnel.

ODS supplies a one-year warranty and an 800 number. If you purchase a maintenance contract, 24-hour support is available.

ODS offers much of what its competitors has, but at less expense. Some of the missing features may or may not be the deciding factor in your hub decision, but the price may be. With good SNMP management, fair graphing skills, a wide variety of network configurations, and a decent price, ODS can be the right solution for your enterprise networking needs.

FACT FILE

ODS 295
Optical Data Systems Inc., 1101 East Arapaho Rd., Richardson, TX 75081; 214-234-6400; fax, 214-234-1467.

List price: \$2,230 for chassis. 294-21 (power supply module), \$1,590; 294-BT (12-port 10BaseT STP/UTP concentrator module), \$1,695; 294-TFR (11-port 10-BaseT, 1-port 10BaseFL), \$2,195; 294-FR (12-port 10-BaseFL), \$4,095; 294-TN (8-port thin-coax Ethernet module), \$2,245; 294-AU (12-port thick-coax Ethernet module), \$2,350; 294-BTS (12-port standalone 10BaseT module), \$1,795; 294-ATRS (16-port Token-Ring STP/UTP module), \$2,150; 294-BTRF (16-port fiber-optic Token-Ring module), \$2,320; 294-ATRJ (16-port STP/UTP module), \$2,320; 294-ATR9 (16-port Token-Ring STP with DB-9 connectors), \$2,320; 294-BRC (4-port Token-Ring In/Out module with network management), \$3,240; 294-B111 (Token-Ring-to-FDDI router module), \$12,000; 294-B109 (Token-Ring-to-Ethernet router module), \$12,000; 294-9E (SNMP retiming module for Ethernet), \$3,895; 294-TRM (SNMP retiming module for Token-Ring), \$3,730. LANVision for DOS (network management software), \$3,115.

In short: The ODS 295 is the best value among the hubs reviewed here, although its FDDI support is limited. Its bridging function displayed good throughput on our performance tests, but it slowed down when actually passing the frames to another network while filtering them. ODS offers a 20-MHz 386 server module that fits into two slots on the hub.

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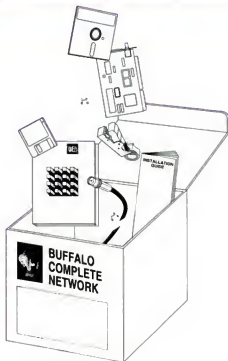
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CIRCLE 328 ON READER SERVICE CARD

SynOptics Communications Inc.

LattisNet System 3000

BY PADRAIC R. BOYLE

If you've got the budget, SynOptics Communications has got the hub. The LattisNet System 3000 offers top-notch management features backed up by leading-edge modules. But our configuration of the System 3000 ran \$20,000 to \$30,000 more than similar solutions.

We tested the 12-slot System 3000 with Ethernet, FDDI, and Token-Ring host, bridge, and router modules installed. The configuration we used for evaluation included three network-management modules for Ethernet, FDDI, and Token-Ring; a Network Control Engine (NCE); and a Sun Microsystems workstation running LattisNet Manager for UNIX to monitor traffic across the network.

SUITABILITY TO TASK

LattisNet System 3000

	POOR	FAIR	GOOD	EXCELLENT
Management	●	●	●	○
Troubleshooting	●	●	●	●
Expandability	●	●	●	●
Fault tolerance	●	●	●	●
Bridging and routing	●	●	●	●

FIVE BACKPLANE DESIGNS

SynOptics offers five different versions of the 3000. Each backplane includes a separate management bus. The 3000-01-HW offers five Ethernet networks. The 3000-04-HW adds two Token-Ring networks. The 3000-05 adds three FDDI networks to the 3000-04. Both the 3000-04 and the 3000-05 also come with redundant power supplies.

A host of modules, from AppleTalk concentrators to routers, plug into these hubs. All have a Flash EPROM or non-volatile RAM for software upgrades across the network.

SynOptics offers Ethernet modules for thinnest, thickest, UTP, and fiber. A security option for these modules, LattisSecure, ensures that only data from a particular Ethernet adapter can travel through a module's port. If an unauthorized card address is plugged into that port, the net-

work manager is alerted and the port is segmented from the network.

The Token-Ring modules are available for STP and UTP cable. Using technology developed jointly with IBM, the SynOptics product reduces jitter and crosstalk by retiming the signal as it passes through the Token-Ring host module, a concentrator module.

Bridge and repeater Token-Ring

modules are available for fiber-optic or STP cabling. With the 3522 Token-Ring bridge and fiber extenders, hubs can be linked from up to two kilometers away. The bridging module can filter out specific protocols and addresses.

The Token-Ring NMM has an on-board 80186-class processor and one megabyte of DRAM to gather and process management data. A secondary ring

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SynOptics' LattisNet management system provides a graphical view of the hub. You can monitor network status via indicators that it color-codes according to the threshold levels you set.

path provides a redundant link. Lights on the front of each module indicate the current operating conditions of each port and whether the network is running at 4 or 16 megabits per second.

The FDDI host modules offer STP and fiber-optic cabling. The FDDI NMM boasts an on-board AMD 29005 RISC processor for high-speed packet processing. The two ports let you create redundant System 3000s for greater fault tolerance. A fully loaded 3000 can accommodate up to 40 FDDI stations. LEDs on the front of the module show the status of each port.

SynOptics offers a Xyplex terminal server for connecting terminals, printers, or modems to the network. The terminal server plugs into the Ethernet bus and can connect 16 devices running at 38.4 kilobits per second. Protocols like TCP/IP and DEC LAT (Local Area Transport) are also supported.

NETWORK MANAGEMENT MODULE

To monitor these modules, SynOptics offers separate network management modules (NMMs) for Ethernet, FDDI, and Token-Ring. The NMMs use the management bus to gather information about the module's configuration, network activity, and diagnostic data at the hub. They provide out-of-band management and also report on port status.

Filters can be set up on the NMM to reduce the amount of management information passed across the network. You can, for example, capture IPX packets and pass only those packets to the management station for analysis. There, the

management station can display the data as a graph or store it as an ASCII file for later analysis.

As a network grows, it's cumbersome to pass filtered data up to the management station. The Network Control Engine (NCE) solves this problem. A powerful 12.5 MIPS (million instructions per second) Sun SPARCstation, the NCE module plugs into the 3000 and processes management data at the hub, passing the results back to the management station. With the NCE installed, the hub can, for example, inform the management station that 1,000 IPX packets were captured, without having to pass the actual packets across the network.

THE NETWORK MANAGEMENT TRIPLE THREAT

SynOptics offers three management packages: Lattis E-Z View, LattisNet Manager for DOS, and LattisNet for UNIX.

Lattis E-Z View, \$695, is a DOS-based Windows product for small Ethernet LANs. It monitors and graphs network activity and fault errors and allows you to set thresholds. If a threshold is met, the agent on the NMM initiates a predefined response, such as partitioning a device from the network.

LattisNet Manager for DOS, which is a Windows package, runs \$3,295. It augments the functionality of Lattis E-Z View with NCE-based protocol analysis and support for Token-Ring networks.

If you need to manage Ethernet, FDDI, and Token-Ring networks, you will want LattisNet for UNIX. This \$6,500 package runs on Sun Microsystems' SNMP console, SunNet Manager. With SunNet Manager, the LattisNet System 3000 allows you to set activity thresholds, automate responses, and analyze data from other SNMP devices, such as routers.

These management packages use a bit-mapped image to represent the networks. SynOptics automatically updates these views in real time. If you pull out a module or install a new one, the image immediately reflects the change.

MANAGEMENT TOOLS

SynOptics offers a number of distinctive management tools. Running on top of LattisNet Manager for DOS and LattisNet for UNIX are the LattisWare Solutions. These tools are aimed at enabling network managers to sift the vast quantity of network management information quickly.

There are five applications—MIBMan, MeterMan, FaultMan, PolicyMan, and TrendMan. All run on Unix; MIBMan and MeterMan are also available for DOS.

MIBMan allows you to import other vendors' MIBs (management information bases) easily. MeterMan displays network information as a network-health

FACT FILE

LattisNet System 3000

SynOptics Communications Inc., 4401
Great America Pkwy., Santa Clara, CA
95052-8185; 408-988-2400;
fax, 408-764-1197.

List price: 3000-01 (12-slot Ethernet-only chassis with power supply), \$2,295; 3000-05 (12-slot Ethernet, Token-Ring, and FDDI chassis with power supply), \$4,495; 3308A (12-port 10BaseT module), \$1,495; 3307HD (24-port 10BaseT module), \$3,295; 3313-02 A (2-port Ethernet network management module), \$4,895; 3502A (12-port STP/UTP Token-Ring module), \$1,295; 3505A (12-port UTP Token-Ring module), \$1,795; 3513-A (Token-Ring management module with STP repeater), \$5,195; 3902 (4-port STP FDDI host module), \$4,995; 3904 (4-port fiber optic FDDI host module), \$7,495; 3910S-04 (FDDI network management module), \$14,995; 3383-02 (Ethernet local router), \$5,895; 3386-02 (Ethernet remote router), \$6,495; 3323S (Ethernet local bridge), \$3,795; 3356 (Ethernet remote bridge), \$8,800; LattisNet Manager (Unix-based network management software), \$3,995; LattisNet Network Management for DOS (DOS-based network management), \$3,495.

In short: SynOptics' LattisNet System 3000 offers a top-notch but expensive solution for managing a network. Its Network Management modules allow you to filter out unwanted data, while its Network Control Engine gives you quicker access to management data. SynOptics also offers a number of powerful management programs, including several specialized utilities. And it recorded the best throughput with 64-byte packets on our tests. SynOptics is developing Ethernet switching technology that should greatly improve speeds on multiple Ethernet segments.



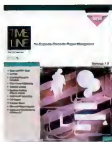
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meter. FaultMan uses rules to analyze data to locate network faults. PolicyMan creates industrywide rules restricting network access. TrendMan automates baselining for troubleshooting the network.

LOOKING TOWARD THE FUTURE

Until ATM (asynchronous transfer mode) becomes widespread, SynOptics will offer an interim solution—the EtherSwitch. Expected to be available by year's end, the EtherSwitch uses technology developed by Kalpana to switch packets between multiple Ethernet segments.

SynOptics is also developing a single router that will connect Ethernet, FDDI, and Token-Ring networks, and it is working with Cisco Systems to form the "Rub System"—a combined router and wiring hub.

SynOptics offers a one-year warranty on all of its products. Technical support is provided by value-added resellers.

SynOptics offers an excellent solution, with scalable, intelligent hubs and network management tools that are appropriate for small, medium, and large enterprise networks. Only large installations, though, may have the budgets to afford the package.

Ungermann-Bass Inc.

Access/One

BY PADRAIC R. BOYLE

If you need an Enterprise hub that can connect not only Ethernet, FDDI, and Token-Ring devices but even non-networked terminals, then take a close look at Ungermann-Bass's Access/One.

Ungermann-Bass (UB) has been in business since 1988, and it offers the oldest and perhaps most tested wiring hub in this review. But "oldest" can also mean limitations as well as reliability. Some of the modules do not offer the top-notch performance of their competitors; other modules can be connected only with an external cable.

The Access/One system that we examined for this review consisted of an 11-slot hub, a Supervisor module, and Ethernet, FDDI, and Token-Ring modules. To monitor our network, we installed NetDirector, UB's network management package, on a PC with OS/2.

You can also purchase the Access/One in two- and five-slot chassis. In addition, UB has released a separate hub, the Access/Open, which uses standard EISA, ISA, and MCA option cards instead of proprietary modules.

A CENTRAL SUPERVISOR

NetDirector manages the Access/One through a single supervisor module, rather than a separate module for each type of installed network, as with competing products.

The Supervisor gathers data from the modules via the control bus. Two other buses—the 10-megabit-per-second QE (Quick Ethernet) Bus and the 320-Mbps PlusBus—connect the modules.

The QE Bus can support 10 Ethernet networks (each Ethernet module being a separate network). The PlusBus system bus currently accepts only FDDI modules.

No Token-Ring bus is available internally; you can connect Token-Ring networks to Ethernet by plugging in a bridge, or use external cables to connect Token-Ring modules.

MODULES FOR EVERY NETWORK

UB offers more than 25 different modules. These range from concentrator modules to asynchronous and 3270 interface modules.

The double-tier 10BaseT concentrator module connects as many as 12 10-BaseT devices and offers one AUI (attachment unit interface) device. For added reliability, fault-detection logic, such as a link integrity test, monitors each port.

With the addition of a daughterboard, more complex networks can quickly locate problems. The daughterboard lets you simultaneously monitor more than one port-level statistic. The board also cross-references the MAC addresses of the attached devices with NetDirector's database.

As with the Ethernet module, UB's Token-Ring module has two tiers of functionality. Each module supports up to 12 Token-Ring stations, on 4-Mbps or 16-Mbps networks. To expand your Token-Ring network, you can externally connect ring-in and ring-out ports.

A plug-in daughterboard for the Token-Ring concentrator module eliminates jitter on the Token-Ring network, letting you install up to 235 stations on

SynOptics is working with Cisco Systems to create a combined router and hub—the "Rub System."

FACT FILE

Access/One

Ungermann-Bass Inc., 3900 Freedom Circle,
Santa Clara CA 95052; 800-777-4526,
408-496-0111; fax, 408-970-7300.

List price: ASE2000 (2-slot chassis, \$995), ASE3000 (5-slot chassis, \$2,095), ASE7000 (11-slot chassis), \$2,495. ASE7000-115 (internal power supply), \$1,650; ASM700 (SNMP management module), \$3,350; ASM320T (12-port 10BaseT concentrator module), \$1,450; ASM900 (8-port thin coax Ethernet concentrator module), \$2,800; ASM800 (fiber-optic Ethernet concentrator module), \$2,850; ASM5300 (local Ethernet bridge), \$3,950; ASM410T (12-port Token-Ring STP/UTP concentrator), \$1,150; ASM1000/4 (4-port FDDI concentrator module), \$12,000; ASM5361 (FDDI-to-Ethernet local bridge/router), \$19,995; ASM1000/10 (10-port FDDI concentrator module), \$26,000; ASM1000/16 (16-port FDDI concentrator module), \$40,000. NetDirector (OS/2-based network-management software), \$8,000; ProTools Foundation Manager (OS/2-based protocol analyzer), \$8,995.

In short: Ungermann-Bass's Access/One is showing its age a bit and its Ethernet bridge runs slower than the competition. But it remains generally versatile and allows centralized management of many types of networks connected to a hub. The management software, NetDirector, runs with OS/2 and takes advantage of Microsoft SQL Server to create a SQL database.



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SUITABILITY TO TASK

Access/One

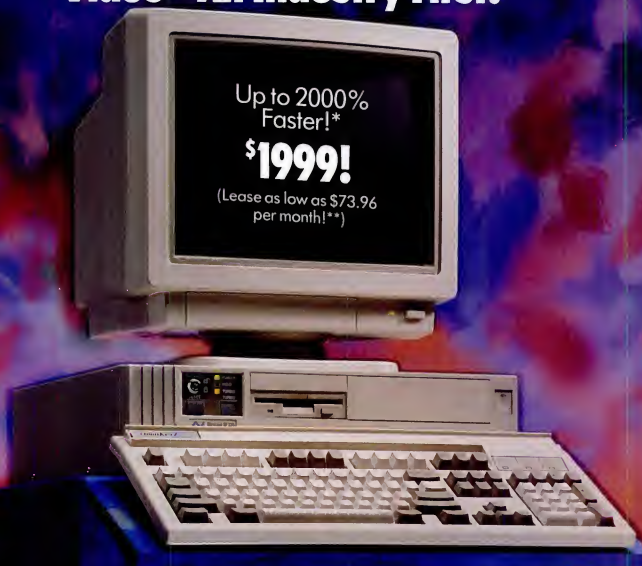
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Troubleshooting	●	●	●	○
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Fault tolerance	●	●	●	○
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NETWORKING

Enterprise Hubs

a single ring for UTP and STP wiring. As with competing products, the daughter-board automatically detects and segments a beaconing network adapter. Network and port-level statistics are also available. LEDs on the concentrator module indicate port status, module status, and automatic fault recovery.

The FDDI-Ethernet bridge module has two on-board Intel 960CA RISC processors to speed up packet forwarding between FDDI modules connected to the PlusBus. You can add a separate unit and turn the FDDI module into a single or dual-attached station.

The multiprotocol remote bridge/router can route IP, XNS, IPX, and DECnet protocols across Frame Relay or T1. Software is also available for AppleTalk's Distributed Datagram Protocol.

UB also offers a local Ethernet-to-Ethernet bridge, which did not perform well in our testing. UB attributes this performance to the bridge's five-year-old architecture. The company hopes to solve this problem with the release of a new RISC-based bridge by the end of this

year or the beginning of the next.

Of the hubs we tested, the Access/One was the only product not to have the network connections on the front of its modules. Fifty-pin Telco connectors are on the back of each card and come out of the back of the chassis. There are cables between the card and a punch-down block or patch panel to break out the connections. This is convenient when it comes to replacing a defective module, because you don't have to unplug all the other modules, as you do with other hubs.

MANAGING THE HUB

Getting information from a wiring hub is crucial—that's why UB supplies its powerful, OS/2-based NetDirector. Unlike many of its competitors, the NetDirector uses client-server technology. The client, the NetDirector interface, stores and retrieves information from Microsoft



Ungermann-Bass's OS/2-based NetDirector management system lets you view statistics about the Access/One hub while querying a SQL database about devices located across the network.

SQL Server.

The client-server design allows you to access information from anywhere on the network. In addition, you can use standard reporting tools built for SQL Server.

UB claims that NetDirector is the only network management system that can store all the SNMP device information in

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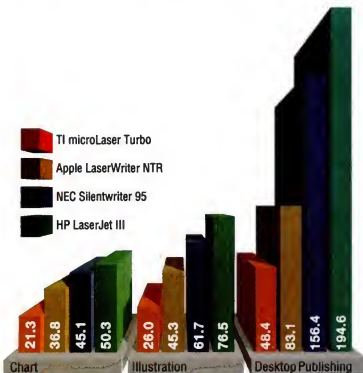


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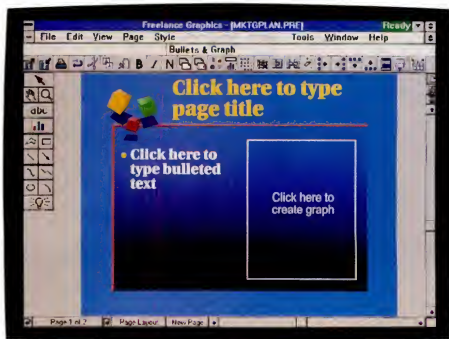


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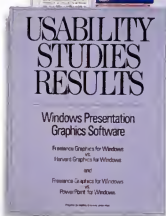
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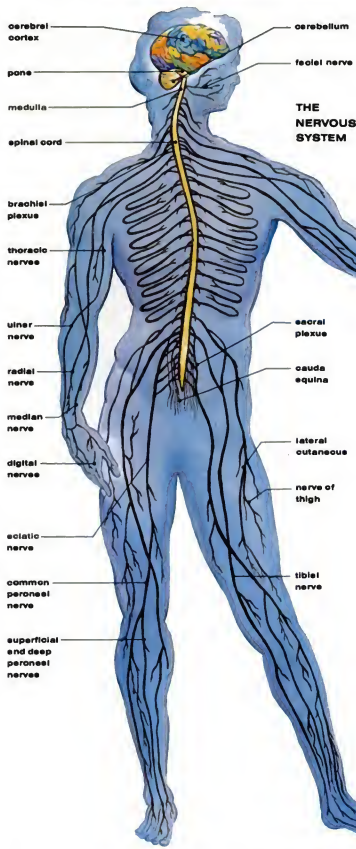
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HUBS INSIDE THE PC

Wiring Hubs: The Low-Cost Alternative

a common SQL database. Using a SQL database makes installing and configuring new devices easier. User-defined fields also store extra information about network devices—such as their location and serial number.

NetDirector is fairly simple to use, although it lacks some of the glitzy graphics of its Unix-based counterparts. It provides bitmap images of hubs and their locations, but the images are not updated in real-time. What's more, NetDirector provides most data in cumbersome-to-read raw numbers rather than graphs. You can, however, use Dynamic Data Exchange (DDE) to graph the data in Excel.

NetDirector's lack of protocol analysis is another drawback. To solve this problem, UB plans to have ProTools' Network Control Series network management software incorporated into NetDirector by this month.

When the SNMP agent detects a problem, audible and visual alarms inform you of a fault; a record of the warning is stored in an event log. Five fault-severity levels are color coded and can be customized for a group of errors or thresholds. The event log is stored in a format that can be exported into Lotus 1-2-3 or Microsoft Excel for trend analysis. The event log has a filter for viewing the data by device, event type, or time interval.

ON THE HORIZON

UB is strengthening its product line through strategic alliances. For its ATM (asynchronous transfer mode) and multimedia solutions, UB has been working with BBN Communications Corp. Through an agreement with Microsoft, UB will use LAN Manager within its hub for communicating with WANs. UB is also working with other companies, including British Telecom, GTE Corp., Motorola, and Novell.

UB provides a one-year warranty on all parts. Support is available through VARs or from UB's Customer Support Organization.

For future networks, the Access/One's interconnectivity and speed will depend on its PlusBus and RISC-based modules. For now, this hub offers many other capabilities. Strong SNMP management and flexibility make the Access/One a tough contender.

New technology from Novell offers wiring-hub functions at a fraction of the cost. Here's what you can expect from these low-cost NetWare-based solutions.

Forget the checkbook—break out the piggy bank. You're about to embark on a wiring scheme that's going to cost hundreds, not thousands, of dollars. Impossible, you say? Not with hub cards.

Thanks to a management specification from Novell, you can now wire small- to medium-size networks with a hub based on simple network management protocol (SNMP) cheaply. Instead of \$100 or \$150 for each managed port, you'll need to spend only about half that.

The specification, called the hub management architecture (HMA), enables hubs the size of an EISA or ISA adapter card (hence the name hub card) to slide

into a client PC or file server. Though hub cards have been available for some time, typically they've required the hub vendor to create network-management software.

With HMA, vendors can now rely on Novell to supply network management through a NetWare Loadable Module (NLM) called HubCon. Many of the leading hub vendors, including Cabletron Systems, Chipcom Corp., SynOptics Communications, and Ungermann-Bass, have announced support for HMA.

THE HMA ARCHITECTURE

HMA centers around an interface that Novell calls the hub management interface (HMI). HMI contains five extensions to Novell's driver standard, the Open Data-link Interface (ODI), that allow vendors to write drivers that gather management information from the hub cards. The drivers pass this information up through HMI to HubCon or an SNMP management agent in the file server.

To date, two vendors have shipped or announced hub cards for HMA. Intel's EtherExpress TPE Hub is priced at \$749 for ISA and \$849 for EISA machines. Both models provide a LAN adapter with 12 10BaseT ports. Intel's \$649 EtherExpress Expansion Hub is an ISA-bus device that you can use to add another 12 ports, or use as the managed hub in a PC with an existing network adapter.

Eagle Technology announced its hub-card around press time. The \$840 NE32HUB-Base contains 12 RJ-45 ports on a 32-bit 10BaseT adapter. If you already have a network adapter installed

or need more than 12 ports. Eagle also offers the NE32HUB-TPE, a \$640 12-port hub without the 10BaseT connection. Thinnest support is also available.

WINDFALLS AND PITFALLS

HMA allows you to combine low-level statistics with higher-level network operating system information to troubleshoot networking problems. HubCon, for example, gives you information that's more specific than merely the address of a networked PC—you can identify the user connected to a particular port.

Although hub cards seem like the perfect answer to network management woes, be careful about placing the hub card in the file server, especially one that

has been operating well for months. Unlike wiring hubs, PCs don't allow you to plug and unplug modules without turning off the hub; you'll need to bring the server down to replace the hub.

Software may also present a problem. Running more NLMs (NetWare Loadable Modules) in the file server requires more memory and processing power. Many network managers are simply reluctant to add another application, in this case HubCon, to the file server.

What's more, while HubCon can monitor and report on Ethernet hub cards, there still isn't a standard interface for Token-Ring hub cards. Some vendors, such as Chipcom, have extended HMA, but the Token-Ring management

applications they've created will only function with hub cards supporting these vendors' own HMA extensions.

Finally, file servers and wiring hubs typically aren't located in the same room. The wiring hub is designed to be located in a wiring closet—not the ideal place for a file server, and an even worse place if you have printers physically attached to the file server.

Hub cards hold great promise for small networks, where wire can be laid along the baseboard behind users' desks, and also in very large organizations, where a manager can plan and install server rooms with terminations for the wiring, adequate environmental control, and backup power for the servers.

▪ Roll Your Own Hub

by Jeffrey L. Carrell

What's it like to build your own wiring hub? To answer that question we set out to create a 24-port wiring hub. We used a Compaq 386/25e with a 12-port Intel EtherExpress Hub Adapter and the EtherExpress Expansion Hub for 12 more ports. For management, we relied on HubCon, Novell's management utility that runs on the file server.

We found that ease of installation is perhaps more crucial with hub cards than with other products. If you're going to rely on the vendor's network connection, then you will need to buy a hub card that will have minimal impact on the file server, so be sure to look for low CPU utilization.

Although we did not evaluate the CPU utilization of the EtherExpress, we did look at its installation. You'll want a hub card that's software configurable—exactly what the EtherExpress offers through its HubSetup utility.

HubSetup's method for resolving conflicts is a time-consuming annoyance. Rather than finding a free interrupt or memory address, HubSetup responds to a conflict with another option board by requiring you to remove the other card, reconfigure the hub card, and then reinstall the other option card.

You also need to follow some gen-

eral rules when installing hub cards in the PC. First, you can have only one network adapter in each cluster, or group of eight hub cards. The rest of the hub cards must be expansion boards. If you need multiple clusters, your only limitation is the number of computer slots you have at your disposal.

If you require a connection from the cluster to an external source, then you must install the AUI Port accessory. This connects to only one hub board and requires one slot for the connector. If you are already running low on slots inside your computer, sacrificing this slot may be a particularly painful step—a situation that Intel needs to address.

Because the wiring hub is independent of the network protocol, you would think that the hub card would also be independent of the network protocol. Not so. Because the hub card also connects to the server, you need to load a driver as well. Though the manuals do not specifically discuss using multiple protocols with these cards, I was able to load IPX (Internet Packet Exchange) and AppleTalk protocols and successfully log on to the file server from a PC as well as a Macintosh client. If you've installed IPX or AppleTalk before, you should be able to configure the drivers without any problems.

You will need HubCon to manage the wiring hub. If you are familiar with other Novell utilities, HubCon will be a cinch for you. It offers the standard C-Worthy interface and tracks all the essential statistics: status and statistical information viewed by port and by board, board-level and port-level control, and notification if the board or port are deactivated or not functioning within the 10BaseT specification.

The manuals for the Intel EtherExpress TPE Hubs provide detailed instructions on how to configure and install the products. They also provide an ample number of diagrams that provide further clarification. Both of the manuals offer a table of contents, a glossary, troubleshooting sections (not only for the product, but for the network in general), error messages, and an index.

The only things that might be added would be more information about the various configurations available for running different protocols on the cards, more information concerning what can be put into the AUTO-EXEC.NCF and file server startup file, and more instruction on installing multiple EtherExpress boards in the same computer. Free service is provided via fax, BBS, CompuServe, and MCI Mail. A flat fee for phone support (after first time installation) is also provided. □

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OTHER IMPLEMENTATIONS

Vendors have tried a few other alternatives to standalone hubs. Some vendors, such as NetWorth, have placed a server in the wiring hub. In this setup, an optional module inside the hub runs Novell's NetWare Runtime, Version 3.11. The machine can then run NLMs such as HubCon, but cannot offer file or print services. Placing the file server inside the wiring hub gives you the benefit of the wiring hub's rugged architecture. If a module should fail, you can swap it out and insert a new one. You still have to pay for the wiring hub, however.

Another alternative is the Remote Hub Agent from Intel. This \$99 option redirects HMI calls across the network to the server running HubCon or Novell's SNMP agent. You place the Ether-Express TPE Hub in any DOS-based PC and manage it using HubCon.

SHOPPING FOR HUB CARDS

Know your configuration and your growth plans before you make a purchase. If you plan to use an HMA-compliant hub-card in your file server, make sure you have enough expansion slots available and that you can put the hub at the center of the wiring installation. If you have only eight slots, you'll need an expansion chassis or another server to support the more than 100 LAN nodes.

Most HMA-compliant hub cards are based on a server/slave configuration. The first card you install in your server works as a wiring hub and a network interface card. Each additional hub card is daisy-chained to the original card via a short ribbon cable and acts only as a hub, not a network adapter. If you already have a network interface card, you typically do not need to purchase the card that provides the network interface.

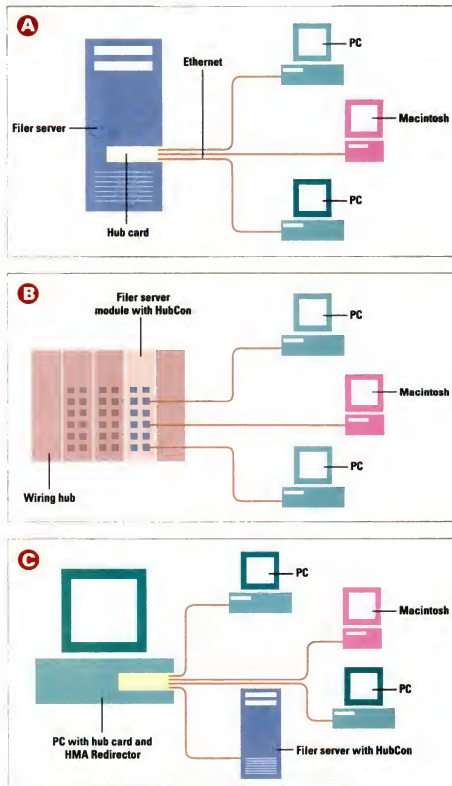
To operate effectively in a server, hub cards need fairly high throughput while minimally impacting server-based apps. Typically, a 16- or 32-bit adapter that implements bus mastering is a good choice.

The HMA specification enables vendors to produce manageable wiring hubs less expensively. If you're looking to connect a small group of PCs, hub cards can be a great solution. For larger networks, be prepared to spend more money on dedicating a machine to the hub card or using one of the other hub alternatives. □

The Different Flavors of HMA

There are three basic ways to implement hub management architecture (HMA). The least expensive, hub cards, typically puts the hub in the file server (A). Some vendors, such as NetWorth, create a file-server module that slides into the wiring hub and runs HubCon, a

management application (B). A third approach, the HMA redirector, is currently offered by Intel (C). It places a hub card in a PC and redirects HMA calls across the network to the file server running HubCon.



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Programming

UTILITIES

TIME!: A Threefold Digital Timer for Windows

BY DOUGLAS BOLING

Through its built-in controls, the Windows interface delivers bonuses to both users and programmers. Users benefit because every control within an application works in a friendly and familiar way—radio buttons, check boxes, and list boxes, to name a few. The ease of use and time savings come about with relatively little development investment, too. Programmers no longer need to wrestle with gruesome implementation details to create a slick, serviceable interface, thanks to these Windows controls supplied by Microsoft. Disparate applications also gain a common look because developers find these standard tools so much easier to employ than roll-your-own code. Again, end users reap the rewards.

Windows promotes standardization, but allows for some extension by providing programmers with the means to create custom controls specifically designed for an application. TIME!, this issue's utility, demonstrates the use of these controls, while simultaneously delivering a useful program.

You can download TIME!.EXE and the source code from Library 2 (PCMag Utils) of the Utilities/Tips Forum on PC MagNet archived as TIME!.ZIP. If you just want the files you need to run TIME!, download the self-extracting archive TIME!.EXE. For instructions, refer to the sidebar "Utilities by Modem." If you don't have a modem, you can obtain the files directly from PC Magazine by sending a postcard with your name, address, and preferred disk size to the attention of Katherine West, PC Magazine, One Park Ave., New York, NY 10016. Or you can fax your request to 212-503-5799 (no

phone calls please). Compiling TIME! requires Borland C++ 3.0, or Microsoft C 6.0 and the Windows 3.x SDK (Software Development Kit).

USING TIME! TIME! works the way the cooking timer in your kitchen does. The program actually contains three independent timers, each with the ability to be set, started, and stopped. All share a single display, however, so only one timer's setting can appear during any given period; the three buttons immedi-

ately below the display let you make your selection. Pressing the Timer 1 button, for example, instructs the program to show time remaining on its first timer. A black bar above the button indicates the timer you've chosen.

*TIME!, this issue's
utility, is a triple digital
timer that shows
programmers how
to implement custom
controls in Windows.*

ately below the display let you make your selection. Pressing the Timer 1 button, for example, instructs the program to show time remaining on its first timer. A black bar above the button indicates the timer you've chosen.

The three timers can run simultaneously. The digital display shows the time remaining until the currently selected

timer reaches zero. Figure 1 shows the TIME! window.

The Minute and Second buttons allow you to set the time. To add a minute to the currently displayed timer, you simply press the Minute button. The Second button works the same way. The buttons function only if the timer is stopped.

The Start/Stop button performs its functions on the displayed timer only. If the timer is running, the button is labeled Stop; otherwise it says Start. A timer can be started and stopped repeatedly. When restarted, the count continues from the currently displayed time. For example, if you halt a timer that is showing 0:59, add one minute, and reactivate it, counting continues from the new time—1:59.

A shortcut allows you to quickly set the displayed time with a minimum of effort. Clicking the left mouse button on a digit increases it by one. Clicking the right button decreases it a unit. Again, the timer must be stopped.

After you've set and started one or more timers, you can minimize the TIME! window. When one of the timers expires, TIME! pops to the foreground and beeps the speaker.

The look of the TIME! digits can be set to resemble either a liquid crystal display (LCD) or a light-emitting diode (LED) display. In LCD mode, TIME! displays the digits as black numbers on a gray background (like LCD watches). LED mode produces red numbers on a black background. While LED watches went out of style with Disco, red on black still looks pretty good.

Changing the look is simple. Choose either LED or LCD from the Display menu. Finally, to terminate the program, choose Exit.

To install TIME!, copy the files

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■ Utilities by Modem

The *PC Magazine* utilities are available by modem from PC MagNet, a ZiffNet service hosted by CompuServe.

To find the phone number nearest you, set your communications software to 300, 1,200, 2,400, or 9,600 bits per second, 7 data bits, even parity, 1 stop bit, and full duplex, then dial 800-346-3247 with your modem. When the modem connects, press Enter. At the HOST NAME prompt, enter PHONES. Follow the menus and note the number closest to you. Or you can call 800-635-6225 (voice) and follow the instructions and note the number.

To obtain the current issue's utility free of charge, simply dial the local number; at the HOST NAME prompt, type CIS; and at the USER ID prompt, enter 60116.1. Then, at the PASSWORD prompt, enter PC-MAGUTIL.

To join ZiffNet, at the USER ID prompt, type 177000,5000. Then, at the PASSWORD prompt, enter PC* MAGNET. Finally, at the ENTER AGREEMENT NUMBER prompt, type PCMAG92.

TIME!.EXE and DIGIT.DLL into a directory located on your path. As with all Windows programs, TIME! can be run from the Program Manager using the File, Run menu selection. To make running the program convenient, you can install the TIME! icon in the Program Manager using the File New menu selection.

WHAT MAKES IT TICK? TIME! is a simple Windows application constructed (as are many Windows programs) with a non-modal dialog box as its main window. This eliminates the need to use the Windows API to create the controls TIME! needs. The size and position of the controls are specified by the dialog-box template in the program's resource script shown in Figure 2. The resource compiler is used to compile the script file. The resulting file, TIME!.RES, must then be bound into the TIME!.EXE file.

While Windows supplies the standard button controls used by TIME!, it provides nothing that can show a number in

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ZiffNet membership costs \$2.50 per month. This includes access to *PC Magazine* Editors' Choice Awards, Product Reviews index, Weekly News from *PC Week*, Buyers' Market, ZiffNet Highlights, and the Support Forum (which also includes the current utility). CompuServe members can join by entering GO PCMAG at any CompuServe ! prompt.

Outside of these areas, PC MagNet costs \$6.30 per hour for 300-bps service, \$12.80 for 1,200 or 2,400 bps, and \$22.80 for 9,600 bps. Billing is based on 1-minute increments.

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the form of an LCD or LED digit. These are displayed using a custom control called DigitClass, which we'll examine in detail later. Right now, let's look at how to place the control using a dialog box template.

The CONTROL statements in the dialog box template specify the DigitClass controls. The ones digit of the seconds display, for example, is described by the line

```
CONTROL " ", IDD_SECDIG,
    "DigitClass", DIGS_LED |
    WS_CHILD, 95, 5, 30, 40
```

where CONTROL tells Windows to create a control of type DigitClass within the dialog box at the x,y coordinates 95, 5 and with a size of 30, 40. As with all controls, the quantities are specified in dialog units based on the size of the Windows system font. The label IDD_SECDIG refers to the #define statement in TIME.H that

equates the string IDD_SECDIG to 100, the ID tag for this particular control.

DIGS_LED and WS_CHILD are the defined styles for the control. DIGS_LED is specific to DigitClass and indicates that the digit should initially display in red on black. WS_CHILD is a standard Windows style for all window controls and denotes that the control is a child window.

The window procedure for the parent window, WinMain, monitors and commands all of TIME!'s controls. This includes the standard Windows controls (such as buttons and static window classes) as well as the custom DigitClass controls. The procedure is simple, reflecting the simple nature of TIME!. While it does supervise the various controls, WinMain mostly manages the timers.

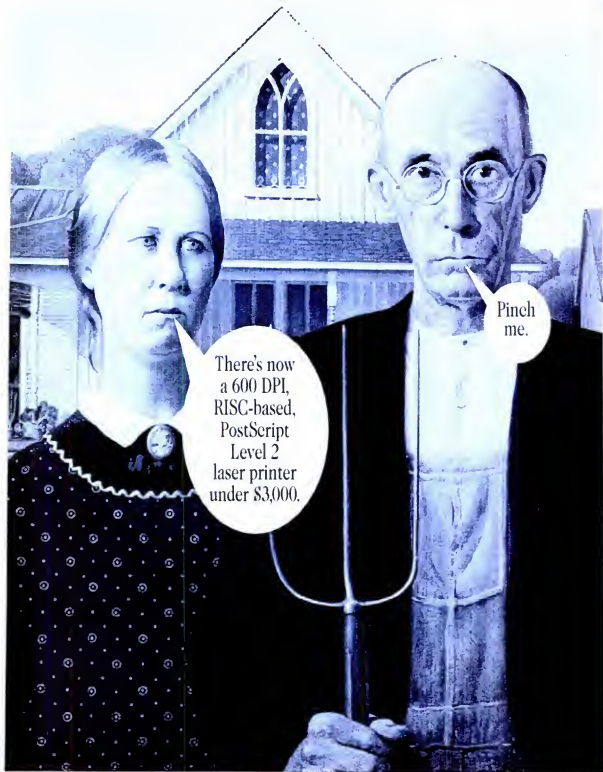
The program's timer function uses just one Windows system timer for all three of its own. The number of Windows timers is limited, so sharing reduces the load on the system. To further lighten demand, the utility only requests a system timer when one of its own runs.

TIME! calls Windows' SetTimer() function to configure a system timer so that it sends a WM_TIMER message once a second. Upon receipt of each such message, the program calls its ComputeTime routine to determine the period elapsed since the displayed timer was started. The DigitClass controls then show the seconds remaining. A call to KillTimer releases the Windows timer when the utility's last timer expires.

The rest of TIME! is straightforward. The construction of the DigitClass custom control and its use are worth looking at, so I'll take the time to elaborate on those subjects now.

WINDOWS CUSTOM CONTROLS Before implementing a custom control, you should ask yourself if you really need it. Windows' standard interface is immensely flexible. It includes numerous controls for both collecting user input and presenting results. Why should a programmer change this interface with a nonstandard control?

The digits in TIME! could have been realized either as a custom control or simply an embedded window procedure. A control is nothing more than a predefined window class packaged in a DLL (dynamic link library). The classic Windows



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CIRCLE 298 ON READER SERVICE CARD

■ PC Magazine Utilities Updates

As with all good software, the programs presented in *PC Magazine* are periodically upgraded and improved. Here's a partial list of the programs on PC MagNet that have been updated. To download these files from the Utilities/Tips Forum, type GO ZNT:TIPS, type LIB or select Libraries from the menu, then select Library 2 PCMAG UTILS. Type DOW and the filename listed below (for example, DOW ANSI.COM), or select Download a File from the menu.

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BCOPY, Version 1.2
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.7
CONFIG.CTL, Version 3.0
DIRMATCH.COM, Version 3.1

EMMA.COM, Version 2.2
EMS40.SYS, Version 1.1
PCACCESS.EXE, Version 1.1
RN.COM, Version 3.0
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
ZCOPY.COM, Version 1.4

For a complete list of the programs that are available on PC MagNet, download PCMCAT.ZIP from Library 0 (New Uploads) of the Utilities/Tips Forum.

A downloadable index to *PC Magazine's* product reviews is also available in Library 1 (General Info). PCM.EXE is a self-extracting file containing the Computer Library *PC Magazine* Reviews Index for January 1988 through December 1991. It requires the search files in PCSRCH.EXE.

push button, for example, could be implemented by each Windows program as a simple window procedure.

Controls hold two main advantages over embedded window procedures, though. The most obvious is that all programs have access to the control rather than each requiring its own window procedure. A more subtle but equally important advantage is that isolating the window class in a control allows you to change the control's logic without recompiling the program.

Your decision about using a custom control, then, should be based on portability across different programs and the likelihood of a change in the logic. If you plan to employ the control in a number of applications or, to facilitate future changes, you want to isolate its logic from the rest of the program, a custom control is the answer. If, however, you only need a special window class for one program, then it may not be worth your trouble to implement the window as a custom control. In the case of the DigitClass control, the decision could have gone either way. I do a large amount of Windows programming, though, so I felt that it might come in handy later.

Once you've decided to make a custom control, how to design the communi-

cation mechanism between the program and the control will be your first problem. The control will be isolated from the rest of the code, so it can't just share global variables! Examining the predefined con-

trols bundled with Windows reveals the solution. Let's look at a standard Windows check box.

A window that creates a check box control can mark it as checked simply by sending it a message. In turn, the check box sends a notification message back to its parent when it's been clicked. Messages are easy and convenient, and they provide the simplest form of Windows communication.

The check box is actually a special case of the standard Button control. Windows defines several messages that let a program govern the look and state of the button, including `BM_SETSTATE`, `BM_SETSTYLE`, `BM_GETSTATE`, and `BM_GETCHECK`. At first, it might appear as if Microsoft reserved a number of messages for the predefined controls and none for custom controls. However, look at `BM_GETCHECK` in the `WINDOWS.H` file supplied with the Windows SDK or Borland's C++ 3.0 compiler and you'll see how Microsoft designed the control messages so that custom controls can use them too.

`BM_GETCHECK` is defined as `WM_USER+0`. Starting at the message number `WM_USER`, Windows reserves a large number of Windows messages for

■ Using the DigitClass Control

Custom controls can be conveniently reused when you program new Windows apps, and this makes them powerful tools. Both the Dialog Box editor in the Microsoft Windows SDK and the Resource Workshop bundled with Borland's C++ 3.1 compiler allow custom controls to be used as if they were part of the standard Windows controls. Let's look at how to use the DigitClass control with the SDK.

Start the SDK's dialog editor and select File Open Custom Control from the menu. A dialog box will appear and you can enter the path to `DIGIT.DLL` and the DigitClass control will automatically be loaded.

To put the control in a dialog box, select the custom icon in the control toolbox. The pointer will change to a box as you move it back over the outline of the new dialog box. Click the

mouse inside the new dialog box to place the control. If you have more than one custom control installed in it, the editor will ask which you want when you press the custom icon.

Using custom controls with Borland's Resource Workshop is just as simple. Select Options Install Custom Control Library from the menu to install the control and choose Controls Custom to place it. Then add the `DIGIT.H` file to the list of #include files used by the project by selecting the Add to Project menu. Since the Resource Workshop comes with a number of custom controls, you will always be asked which you wish to use.

Once installed, it's as simple to use a custom control as any of the standard controls. With custom controls, though, your program takes on a look of its own.—Douglas Boling

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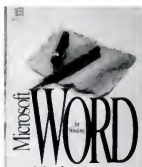
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Figure 1: This figure shows the TIME! window with the four DigitClass custom controls.

window procedures to use as they see fit. One twist seems to foul the works, though: The standard controls also employ this range of WM_USER message numbers for command messages. EM_GETSEL, used by the edit control, for instance, is also defined as WM_USER+0.

Since a number of controls use the same message number for different commands, what prevents chaos? In the case of the example above, since you send the BM_GETCHECK message to a check box and EM_GETSEL to an edit control, each control remains unaffected by the other's use of the same message number.

Just as messages command a control, they also are issued when a control must notify its parent window of an event. In this case, though, the neat trick of using numbers that are offsets from the WM_USER message won't work. Not only could different controls send notification messages with different meanings to the same parent, the parent window might employ the WM_USER range of message numbers for its own purposes. As with the control messages, the solution can be found in the design of the predefined controls.

When clicked, the check box control notifies its parent by sending a WM_COMMAND message containing lParam, which holds the notification code in its upper word and the handle of the check box window in its lower word. The ID number of the control, set when the control was created, is found in wParam. Using unique IDs for each of its child window controls, the parent determines precisely which one sent the message and

with that, figures out the meaning of the notification code in lParam. The WM_COMMAND notification system is used by all of Windows' standard controls.

THE DIGITCLASS CONTROL
DigitClass—a rather simple control—displays a number between 0 and 15, representing those above 9 in hexadecimal fashion, where the letter A corresponds to 10, B to 11, and so on. (Actually, TIME! never shows hex numbers, but including this ability gives DigitClass more flexibility for future applications.) The control accepts no number greater than 15 and a program can instruct it to further restrict the permissible range (to numbers between 0 and 5, for example).

You can view the choice of this upper limit as equivalent to determining the control's numerical base. Configuring the DigitClass control to accept nothing above 9, for example, is the same as making its base 10. (In base arithmetic, only numbers below the base are valid.)

Using GDI (Graphics Device Interface) commands, DigitClass draws lines to simulate the seven segments of LCD

and LED displays. Depending on the control's style setting, a decimal point and a colon can be presented in addition to the number, and the colors can be set to either the LCD or LED mode.

The control also remembers the displayed numeral; once set, the DigitClass control will continue to show it until instructed by another command to change the display.

The number displayed by a DigitClass control can be incremented or decremented simply by sending a message. Normally, when the control receives an increment command, it advances the stored number and displays it. If a number grows larger than the preset upper limit (its base), then it sets itself to 0 and sends a carry message. If the number decrements below 0, then it sets itself to the largest valid digit and sends a borrow message. The display is then set to 0.

Finally, the number stored, the style, and the current base setting can also be queried using various messages, as we'll see shortly.

GET THE MESSAGE? The DigitClass control uses the WM_USER message range for passing command messages, as do standard window controls. Seven messages (WM_USER+1 to WM_USER+7) are defined for the control: DIGM_SET,

MAIN WINDOW DIALOG BOX

Complete Listing

```

//-----
// Main window Dialog box
//-----
WinTime DIALOG LOADONCALL MOVEABLE DISCARDABLE 100, 122, 130, 120
STYLE WS_BORDER | WS_CAPTION | WS_DLGCOLOR | WS_SYSMENU | WS_MINIMIZEBOX

CLASS "Time!"
CAPTION "Time!"
FONT 8, "MS Sans Serif"
MENU WinTime
BEGIN
    CONTROL "", IDO_TMINDIG, "DigitClass",
        DIGM_LED | WS_CHILD, 5, 5, 30, 40
    CONTROL "", IDO_MINDIG, "DigitClass",
        DIGM_LED | WS_CHILD, 35, 5, 30, 40
    CONTROL "", IDO_SECSDIG, "DigitClass",
        DIGM_LED | WS_CHILD, 65, 5, 30, 40
    CONTROL "", IDO_SCDIG, "DigitClass",
        DIGM_LED | WS_CHILD, 95, 5, 30, 40

    CONTROL "", IDO_MTIME1, "static", SS_BLACKRECT, 5, 48, 36, 2
    CONTROL "", IDO_MTIME2, "static", SS_BLACKRECT, 47, 48, 37, 2
    CONTROL "", IDO_MTIME3, "static", SS_BLACKRECT, 89, 48, 36, 2

    PUSHBUTTON "Timer 1", IDO_BTIMER1, 5, 52, 36, 15
    PUSHBUTTON "Timer 2", IDO_BTIMER2, 47, 52, 37, 15
    PUSHBUTTON "Timer 3", IDO_BTIMER3, 89, 52, 36, 15

    PUSHBUTTON "&Minutes", IDO_BMINUTES, 5, 72, 57, 20
    PUSHBUTTON "&Seconds", IDO_BSECONDS, 60, 72, 57, 20

    PUSHBUTTON "Start", IDO_GO, 5, 97, 120, 20
END

```

Figure 2: This is the listing of the dialog-box template for the main window of TIME!. The four statements starting with the word CONTROL are the lines that specify the instances of the DigitClass control.

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InfoWorld, May 11, 1989; EBM, December, 1991; PC World, March, 1990;
PC Computing, June, 1992; August, 1992.
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DIGM_GET, DIGM_INC, DIGM_DEC, DIGM_SETBASE, DIGM_GETBASE, and DIGM_BLANK. Since programs that use the DigitClass control need to know which message number goes with which command, the numbers are assigned in the separate file DIGIT.H, which is listed in Figure 3.

DIGM_SET sets the number that the control will display. The number is passed in the message's wParam (lParam is not used). The number can be between 0 and 15 as long as it does not exceed the base of the control. If a program attempts to set a number above the base, the DigitClass control sets the number to one less than the Base.

The DIGM_SETBASE message sets the numeric base, with the base passed in wParam. Like DIGM_SET, the DIGM_SETBASE message does not use lParam. Since 15 is the highest number allowed, 16 is the maximum base value. If a program attempts to set it higher, the control forces it to 16. The minimum possible base is 2.

DIGM_INC advances the displayed number and DIGM_DEC decrements it. These messages use neither wParam nor lParam.

DIGM_BLANK instructs TIME! to blank the display. DIGM_GET and DIGM_GETBASE let the parent window query the control about the number displayed and the base, respectively. These three messages use neither wParam nor lParam.

No messages exist that govern the display of the decimal and colon but they,

as well as colors, can be managed by setting the style bits for the control. The Windows API function calls, GetWindowLong and SetWindowLong, accomplish the task.

The DigitClass control uses the same WM_COMMAND notification scheme as the standard controls, employing one of four notification codes: DIGN_CARRY, DIGN_BORROW, DIGN_LCLICK, and DIGN_RCLICK. As with the standard Windows controls, the codes are sent in the high word of lParam (in a WM_COMMAND message). The low word of lParam holds the control window handle and wParam carries the control ID.

The notification codes themselves are fairly self explanatory. DIGN_CARRY is sent when the DigitClass control is incremented past its base. If, for example, the base has been set to 6 and a DIGM_INC message is forwarded to the control (currently displaying a 5), the control will display a 0 and post a DIGN_CARRY notification to its parent. DIGN_BORROW is posted if the control is decremented below 0. In this case, DigitClass will display one less than the base and then send the DIGN_BORROW notification.

Clicking on the DigitClass control sends DIGN_LCLICK if caused by the left mouse button or DIGN_RCLICK if caused by the right. More specifically, the notification is sent when a DigitClass window receives a WM_LBUTTONDOWN or WM_RBUTTONDOWN message.

CONSTRUCTING A CONTROL DigitClass

is implemented in a DLL (DIGIT.DLL), as are all Windows controls. Bundling the code in a DLL, however, isn't the only overhead incurred when writing a control; a number of required routines must be added to integrate it into the various dialog-box editors that developers use. In the case of the DigitClass control, this involves as much work as writing its window procedure!

As with any DLL, DIGIT.DLL contains a LibMain procedure called when the DLL first loads into memory. The procedure is comparable to the WinMain function called when a Windows program executes. In DigitClass, LibMain registers the DigitClass window class. This allows programs to create DigitClass controls by simply loading DIGIT.DLL and calling one of the window-creation functions (such as CreateWindow).

The next series of dynamic link library procedures are specific to custom-control DLLs and follow the naming scheme recommended by Microsoft. The names of the routines—DigitWndFn, DigitInfo, DigitStyle, DigitDigFn, and DigitFlags—are customized for the DigitClass control. Following this guideline, procedure names for a custom control called WigIt, for example, would be WigItWndFn, WigItInfo, WigItStyle, and so forth.

The routines are referenced by their ordinal numbers. The ordinal number for a procedure is its position in the list of callable routines in the DLL header.

DigitWndFn is the window procedure

DIGIT.H Complete Listing

```
//-----
// DIGIT.H -- Include file for DIGIT.DLL and the DigitClass Control
//
// (c) Douglas Boling, 1992
//-----
// Digit Control Styles
//
#define DIGS_LED      0x0001L
#define DIGS_BLANK    0x0002L
#define DIGS_COLON    0x0004L
#define DIGS_DECIMAL  0x0008L
//
// Digit Control Style labels (These strings must match above defines.)
//
#define DIGS_LEDSTR    "DIGS_LED"
#define DIGS_BLANKSTR  "DIGS_BLANK"
#define DIGS_COLONSTR  "DIGS_COLON"
#define DIGS_DECIMALSTR "DIGS_DECIMAL"
//
// Digit Control Messages
//
#define DIGM_SET      (WM_USER+1)
#define DIGM_GET      (WM_USER+2)

#define DIGM_INC      (WM_USER+3)
#define DIGM_DEC      (WM_USER+4)
#define DIGM_SETBASE  (WM_USER+5)
#define DIGM_GETBASE  (WM_USER+6)
#define DIGM_BLANK    (WM_USER+7)
//
// Digit Notification Messages
//
#define DIGN_CARRY    1
#define DIGN_BORROW   2
#define DIGN_LCLICK   3
#define DIGN_RCLICK   4
//
// IDs for Style and About dialog boxes used with the dialog box editors.
//
#define IDD_ABOUT      200
//
#define IDD_BLANK      101
#define IDD_COLON      102
#define IDD_DECIMAL    103
#define IDD_LED        104
#define IDD_LCD        105
#define IDD_CTLID      106
```

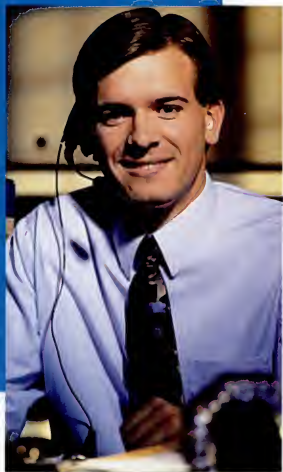


Figure 3: This is a listing of DIGIT.H, the include file for the DigitClass Control.

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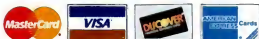
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DIGIT.DEF

Complete Listing

```

-----
; DIGIT.DEF module definition file
;
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-----

LIBRARY            DIGIT

DESCRIPTION        'digit control, Copyright 1992, Douglas Boling'
EXETYPE            WINDOWS
CODE               PRELOAD MOVEABLE
DATA               PRELOAD MOVEABLE
HEAPSIZE           8192

EXPORTS             LIBMAIN
                   MEP                01
                   DIGITINFO          02
                   DIGITSTYLE         03
                   DIGITFLAGS         04
                   DIGITWINFO         05
                   DIGITDLGFM         06

```



Figure 4: This is a link definition file that assigns the ordinal numbers for the DigitClass procedures.

for the DigitClass window and is identical to what would have been written had the control been implemented as a window class inside the program. DigitWndFn handles window messages sent to the window, such as WM_CREATE, WM_PAINT, and WM_COMMAND. It also must manage WM_USER messages that have been equated with control commands. In the case of DigitClass, it deals with DIGM_SET and the other command messages relayed to the control.

DigitWndFn also sends the WM_COMMAND messages containing the notification codes. These messages are sent to the parent of the DigitClass window, as determined by a call to the GetParent Windows API function. Notification messages are sent out in response to the conditions mentioned above. For example, when DigitWndFn receives a WM_LBUTTONDOWN message, it sends the notification DIGN_LCLICK to the control's parent window.

A series of GDI MoveTo and LineTo calls displays the LED segments in response to the WM_PAINT message. The DigitClass window's dimensions determine the position and width of the lines.

Dialog-box editors use the remaining DIGIT.DLL procedures. Both the SDK's editor (DLGEDIT.EXE) and the Resource Workshop bundled with the Borland C++ 3.0 compiler (WORKSHOP.EXE) can load custom controls that use the custom control interface employed by DigitClass. The routines in the custom control DLL allow these editors to use and display the controls without knowing how they work or even what

they look like! To learn how to load and use the DigitClass control in DLGEDIT and WORKSHOP, read the sidebar "Using the DigitClass Control."

The DigitInfo procedure allows a dialog-box editor to query the control for information, such as the copyright, the version number, the control's name, and its default size and style. The procedure itself is simple. It allocates global memory for the information structure, fills in the structure, and then passes the handle back to the editor (which must release the memory block after reading the information).

The dialog-box editor calls DigitStyle to instruct the custom-control DLL to display the control's Style dialog box. Most dialog-box editors call this routine when the user double-clicks on the control. Suppose a user double-clicks on a DigitClass control (to set its styles) just placed on the dialog box being created. In DigitClass, the DigitStyle routine generates a procedure instance for the Style dialog-box procedure, displays the box using Windows' DialogBox function, then frees the instance (with FreeProcInstance) once the function returns.

When DigitStyle is called, a word contains a handle to a block of memory that contains the control's current style structure. The style double-word (DWORD) in this structure contains the current style settings. The dialog box is charged with the job of querying the user about any style changes and passing the new control style back to the editor in the style DWORD.

The window procedure for the style

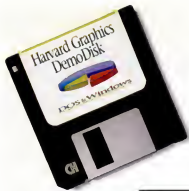
dialog box (DigitDlgFn) is a standard dialog-box procedure that responds to notification messages from the dialog-box controls. The dialog-box controls are defined in the Style dialog-box template bound with the DigitClass DLL. When the user presses the OK button on the Style dialog, its procedure updates the control's Style DWORD and destroys the dialog box with a call to EndDialog. Conversely, if the user presses the Cancel button, the Style DWORD is passed back to the dialog-box editor unmodified.

The DigitFlags procedure translates the state of the style bits into the labels used in DIGIT.H. The labels are then written into the resulting .DLG file for the dialog box. When called, the routine is passed three parameters: the Style DWORD, a pointer to an ASCIIZ string, and the maximum length of that string. DigitFlags must examine the Style DWORD and append the appropriate style tags to the ASCIIZ string. For example, if the Style DWORD has the LED display bit set, DigitFlags would append the DIGS_LED string to the ASCIIZ string. The dialog-box editor would then use the resulting string in the .DLG file's CONTROL statement that specifies the DigitClass control.

The procedures we've discussed provide everything a dialog-box editor needs to create a CONTROL statement in the dialog template. The editor can determine the name of the control class by calling the DigitInfo procedure. The dialog editor can display a custom style dialog box for the control by calling DigitStyle. When the user moves the control, its position and size are determined by the dialog-box editor. Finally, the editor calls the DigitFlags routine to convert the style bits into the labels used in the .DLG file. This combination of routines allows the dialog-box editor to produce the .RES and .DLG files.

DigitClass furnishes a simple example, but it demonstrates all the necessary routines for a custom control. It also demonstrates all the necessary routines for a custom control. And, it demonstrates that the ideas behind the standard controls can be applied to controls customized for specific applications. □

DOUGLAS BOLING IS A CONTRIBUTING EDITOR TO PC MAGAZINE.



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LAB NOTES

Customizing Windows' Common Dialog Boxes, Part 1

BY DANNY THORPE AND PAT RITCHEY

COMMDDLG, the Common Dialogs DLL (dynamic link library) in Microsoft Windows, Version 3.1, has attractions for users and programmers alike. Users like the "smarter" dialog boxes it creates because they're so easy to use. Programmers like these same structures because they plug easily into applications and eliminate the need to write and debug a good deal of not-so-simple code.

The code in COMMDDLG provides a lot of the kind of logic most programmers don't have the time or inclination to implement on their own—things like recognizing media types and displaying appropriate glyphs next to the letters in the drive list. Users attach much importance to such details, but in the development stage those little "extras" get postponed again and again as the programmer deals with "real" programming problems such as finishing the minimum feature set and fixing nasty bugs.

For all the rich features contained in the COMMDDLG library however, the appearance of the actual common dialog box often has less to commend it. A plain white dialog box isn't very exciting if you're accustomed to the snappy appearance of the custom control libraries now on the market. And even if you're not into fancy controls, you may still find that the box you're using with a particular set of option flags would look a lot better if you could arrange or align its controls differently.

The two parts of this article will explore the tricks and traps involved in customizing common dialog boxes to suit your application's visual needs. (If you haven't worked with COMMDDLG before, Ray Duncan's Power Programming

articles in the May 26, June 16, June 30, and July 1992 issues of *PC Magazine* will provide a good introduction to using it in everyday programming.) In this part we'll cover the two kinds of customization opportunities that COMMDDLG provides. We'll also show you how to build an object wrapper around the COMMDDLG interface. In Part 2 we'll

*Your dialog boxes can
look better and do more
if your program takes full
advantage of Windows 3.1's
COMMDDL.DLL
and an OWL wrapper.*

combine these techniques to radically transform the face of the common dialog boxes into Borland-style textured boxes with bitmapped custom controls, without adversely affecting user interaction. Our code examples will use primarily Turbo Pascal for Windows, with a dash of Borland C++ for good measure.

To get a feel for the problem, start Windows 3.1's Write program and select Character, Fonts from the menu. Doesn't it strike you that something's missing from the lower-left quarter of the dialog box? The COMMDDLG Font dialog code itself contains options for selecting a font color and strikethrough or underline attributes, but these are disabled in the default Font dialog box. If, like Write, your program also leaves these options disabled, the lower-left corner of the dialog will be noticeably empty.

Of course, if you enable the options but don't use the results, the user will think that your program is broken. If you disable the options, however, there's that distracting void. If only there were a way to move some of the remaining visible controls to the left a little bit, you could close the gap and give the dialog new balance and symmetry. In fact, there is: COMMDDLG contains hooks and options that allow you to make just such modifications. But should you take advantage of them?

TO CUSTOMIZE OR NOT To Microsoft, the value of a "consistent appearance and functionality from application to application" generally outweighs the advantages of customizing the common dialog box structure. (See the Microsoft Windows Software Development Kit documentation for COMMDDLG in the *Microsoft Windows Programmer's Reference*, Volume 1, page 154.) Microsoft gives you a grudging okay if your application absolutely requires enlarging a dialog box or adding new controls. But hiding controls and changing the "intended functionality" of what the company has provided are officially deemed inappropriate. Microsoft also points out that a program that customizes the common dialog boxes cannot directly benefit from international versions of COMMDDLG (provided by Microsoft), which are written for foreign languages such as French.

Moreover, as with any software product, when you start pushing COMMDDLG.DLL beyond its normal use, you're likely to find a few problems that the designers chose to bury rather than solve. There are a few display and data cross-over bugs in COMMDDLG that become noticeable only when you apply significant customization to your dialog boxes.

FONT.DLG

Complete Listing

```

1543 DIALOG LOADCALL MOVEABLE DISCARDABLE 13, 54, 264, 147
STYLE DS_MODALFRAME | WS_POPUP | WS_CAPTION | WS_SYSMENU
CAPTION "Font"
FONT 8, "Hely"
BEGIN
    LTEXT "&Font:", 1088, 6, 3, 40, 9
    CONTROL "", 1136, "COMBOBOX", CBS_SIMPLE | CBS_OWNERDRAWFIXED | CBS_AUTOHSCROLL | CBS_SORT | CBS_HASSTRINGS |
CBS_DISABLENOSCROLL | WS_CHILD | WS_VISIBLE | WS_VSCROLL | WS_TABSTOP, 6, 13, 94, 54
    LTEXT "Font Style:", 1089, 108, 3, 44, 9
    CONTROL "", 1137, "COMBOBOX", CBS_SIMPLE | CBS_DISABLENOSCROLL | WS_CHILD | WS_VISIBLE | WS_VSCROLL | WS_TABSTOP, 108,
13, 64, 54
    LTEXT "&Size:", 1090, 179, 3, 30, 9
    CONTROL "", 1138, "COMBOBOX", CBS_SIMPLE | CBS_OWNERDRAWFIXED | CBS_SORT | CBS_HASSTRINGS | CBS_DISABLENOSCROLL |
WS_CHILD | WS_VISIBLE | WS_VSCROLL | WS_TABSTOP, 179, 13, 32, 54
    CONTROL "OK", 1, "BUTTON", BS_DEFPUSHBUTTON | WS_CHILD | WS_VISIBLE | WS_GROUP | WS_TABSTOP, 218, 6, 40, 14
    CONTROL "Cancel", 2, "BUTTON", BS_PUSHBUTTON | WS_CHILD | WS_VISIBLE | WS_GROUP | WS_TABSTOP, 218, 23, 40, 14
    CONTROL "&Apply", 1026, "BUTTON", BS_PUSHBUTTON | WS_CHILD | WS_VISIBLE | WS_GROUP | WS_TABSTOP, 218, 48, 40, 14
    CONTROL "&Help", 1038, "BUTTON", BS_PUSHBUTTON | WS_CHILD | WS_VISIBLE | WS_GROUP | WS_TABSTOP, 218, 57, 40, 14
    CONTROL "Effects", 1072, "BUTTON", BS_GROUPBOX | WS_CHILD | WS_VISIBLE | WS_GROUP, 6, 72, 84, 34
    CONTROL "Strikethrough", 1040, "BUTTON", BS_AUTOCHECKBOX | WS_CHILD | WS_VISIBLE | WS_TABSTOP, 10, 82, 49, 10
    CONTROL "&Underline", 1041, "BUTTON", BS_AUTOCHECKBOX | WS_CHILD | WS_VISIBLE, 10, 94, 51, 10
    LTEXT "&Color:", 1091, 6, 110, 30, 9
    CONTROL "", 1139, "COMBOBOX", CBS_DROPDOWNLIST | CBS_OWNERDRAWFIXED | CBS_AUTOHSCROLL | CBS_HASSTRINGS | WS_CHILD |
WS_VISIBLE | WS_BORDER | WS_VSCROLL | WS_TABSTOP, 6, 120, 84, 100
    CONTROL "Sample", 1073, "BUTTON", BS_GROUPBOX | WS_CHILD | WS_VISIBLE | WS_GROUP, 98, 72, 160, 49
    CONTROL "", 1093, "STATIC", SS_CENTER | SS_NOPREFIX | WS_CHILD | WS_VISIBLE, 98, 124, 160, 20
    CONTROL "AaBbYyZz", 1092, "STATIC", SS_CENTER | SS_NOPREFIX | WS_CHILD | NOT WS_VISIBLE, 104, 81, 149, 37
END

```



Figure 1: This is the Windows SDK resource script for the Font dialog. Notice that the last control, "AaBbYyZz" is marked NOT WS_VISIBLE. This hidden control provides crucial information to the Font dialog function.

Thus, if customizing the dialog boxes is important to you and your application, you must be prepared to deal with or work around an occasional COMMDLG glitch or complication.

Still, giving all these considerations their due, guidelines are just that—guidelines—and they can be selectively bent or broken, given adequate confidence and justification.

Another view of COMMDLG is that it is more than just a couple of function calls and a standard user interface; it is a code resource to be built upon, extended, and molded to suit needs more specialized than the general cases the dialog boxes were designed to serve. The value of COMMDLG is that it is a body of code that has an adequate default behavior, but which can be extended into more specialized behaviors.

That last concept—a body of code with a default behavior and interface that can be extended through inheritance—may have a familiar ring. It sounds a lot like the description of an *object* in object-oriented programming. In this article we'll not only describe techniques and guidelines for customizing the appearance of the common dialogs boxes, but we'll also show you how to build an object

wrapper around those dialog boxes.

Why bother with an object wrapper? One compelling reason is that it further simplifies the code you have to write to use a common dialog box. In one respect, the COMMDLG interface is already a model of simplicity: You can't get much simpler than one function call to open a file or choose a font. But there's a catch. In order to make that simple function call you must initialize a data structure, and that process is hardly simple at all.

The Font dialog data structure, for example, has 15 fields, with 24 distinct option flags in one of those fields. The data structure for the Open File dialog has 20 fields and 17 option flags. Some of these

fields pass data into the dialog function, some receive data from the dialog function, and some are bidirectional carriers. Some of the option flags denote mutually exclusive options, while others may be combined with a bitwise OR. Some flags indicate whether or not data fields in the structure contain data to be used by the common dialog code. These fields and flags are all thoroughly documented in the SDK on-line help, but you'll find yourself referencing that help file a good many times before you get to make that one "simple" function call.

By wrapping COMMDLG in an object layer, however, you can hide many of the data requirements as well. Several

Important Common Dialog Names

Name	Function	Data Type	COMMDLG.DLL Resource ID
Open	GetOpenFileName	TOpenFileName	1536
Save As	GetSaveAsFileName	TOpenFileName	1537
Print	PrintDlg	TPrintDlg	1538
Print Setup	PrintDlg	TPrintDlg	1539
Find	FindText	TFindReplace	1540
Replace	ReplaceText	TFindReplace	1541
Font	ChooseFont	TChooseFont	1543
Color	ChooseColor	TChooseColor	CHOOSECOLOR

Figure 2: Most of the dialog templates in COMMDLG.DLL are identified only by integer IDs. This table gives you the Common Dialog names, functions, structures, and resource names.

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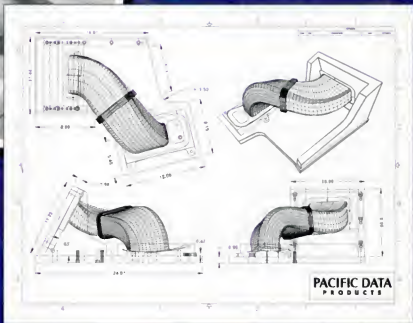
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of the fields of the common dialog data structures require information that is readily available in your application. An example is the application instance handle when you're using an application framework such as an Object Windows Library (OWL). Other fields—structure size, string lengths, function addresses—can be calculated by the object itself. In fact, almost half of the Open File dialog's data fields can be filled automatically by an object. To build an object wrapper around the common dialogs, then, we'll make a family of objects that will set up the data structures for us, clean up afterward, and reduce the volume of information that we have to provide to the absolute minimum. That's making the simple even simpler.

PHASE 1: CUSTOM DIALOG TEMPLATES

Let's start our modifications with a simple dialog template substitution. The *dialog template* is a description of what controls go in the dialog box and where. We'll use the Font common dialog as our example, since you've already seen that its default can stand visual improvement.

Making a common dialog box use a template from your .EXE program (or .DLL) requires setting three fields that are found in all the common dialog data structures. You must:

- Put your program's instance handle in the HInstance field of the data structure;
- OR the Flags field with the `xx_ENABLETEMPLATE` bit flag, (xx varies with the dialog box you're using);
- Set the lpTemplateName field to the name or resource ID of the custom dialog template in your executable.

That's how you tell Windows to load the dialog template from your .EXE file, but where do you get the template itself? The Windows 3.1 SDK provides resource scripts that describe each of the common dialog boxes. The one for Font is called `FONT.DLG`, and it is shown in Figure 1. As an alternative, you can use a resource editor (such as Resource Workshop) to copy the dialog resources of `COMMDDL.DLL` into your own work file. Most of the dialog templates in `COMMDDL.DLL` are identified only by integer IDs rather than string names, but the table in Figure 2 provides the necessary correlation. The Font dialog template is number 1543.

Note that for each of the common dialog boxes, the table in Figure 2 lists the name of the `COMMDDL` function you call to create and launch the dialog box, the name of the Pascal data type that you need to fill and pass to the launch function, and the dialog template name or re-

source ID as found in the `COMMDDL.DLL` resources. The resource IDs shown in Figure 2 are presented only to help you find and identify the dialogs in `COMMDDL.DLL`—your customized versions should be given their own IDs or names.

The names of the data types follow the Turbo Pascal naming convention, which adds a *T* (for type) prefix to the C structure name found in the Windows SDK. `TChooseFont` in Pascal is called `CHOOSEFONT` in C. Remember that while Pascal is case insensitive, C is not, and the SDK structure names and constants are generally in all caps. `TChooseFont` is a Windows 3.1 structure that is defined in `COMMDDL.PAS`, a file that ships with Turbo Pascal for Windows (TPW), Version 1.5, and is used by all the sample programs in this article.

All of these sample programs can be downloaded from PC MagNet. Downloading instructions are provided in the "Utilities by Modem" sidebar in the Utilities column. With Borland's permission, `COMMDDL.PAS` is included with the files that accompany this article so TPW 1.0 users can compile and use our sample programs.

Note that the launch functions shown in Figure 2 are *not* the dialog functions

TEST1.PAS

Complete Listing

```

program Test1;
($R Test1)

uses wintypes, winprocs, wobjects, commdlg;

type
  TMyApp = object(TApplication)
    procedure InitMainWindow virtual;
  end;

  TMyMainWindow = TMyMainWindow;
  TMyMainWindow = object(TNDIWindow)
    procedure cmChooseFont1(var Msg: TMessage); virtual cm_First + 101;
    procedure cmChooseFont2(var Msg: TMessage); virtual cm_First + 102;
  end;

  procedure TMyMainWindow.cmChooseFont1(var Msg: TMessage);
  var
    CF: TChooseFont;
    LF: TLogFont;
    FStyle: array [0..LF_FaceSize] of char;
  begin
    FillChar(CF, SizeOf(CF), #0);
    FillChar(LF, SizeOf(LF), #0);
    FStyle[0] := #0;
    with CF do
      begin
        lStructSize := SizeOf(CF);
        hWndOwner := HWindow;
        lpLogFont := @LF;
        Flags := cf_TTOnly or cf_ScreenFonts or cf_EnableTemplate;
        lpTemplateName := 'MyFontDlg';
        CF.Hinstance := System.Hinstance;
        lpszStyle := @FStyle;
      end;
    end;

    ChooseFont(CF);
  end;

  procedure TMyApp.InitMainWindow;
  begin
    MainWindow := new(TMyMainWindow, Init('Test CommDlg',
      LoadMenu(Hinstance, 'MainMenu')));
  end;

  var MyApp: TMyApp;
  begin
    MyApp.Init('TestCommDlg');
    MyApp.Run;
    MyApp.Done;
  end;

```

Figure 3: This short Turbo Pascal for Windows program displays the normal and modified Font dialog boxes.

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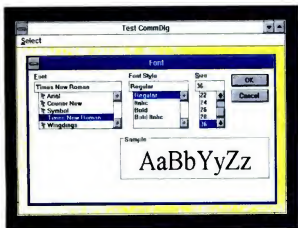


Figure 4: The default Font common dialog box configured with an option set that omits the font color selection or extended attributes check boxes.

contained in the dialog code. A *dialog* function processes messages for a dialog, but the function you call to launch a common dialog box does not process any

messages. The true dialog functions are buried in the heart of COMMMDLG, out of view and out of reach. We'll explore the message processing behaviors of these functions later in this article; for now, just remember that the visible and accessible launch functions are not the same as the internal dialog (message processing) functions.

You should copy the FONT.DLG dialog template to something like MyFontDlg and then save it as TEST1.RC. Before modifying it, let's make sure it works. To provide a tested, TEST1.PAS, a minimal TPW Object Windows application, is shown in Figure 3. It has two menu items and the necessary code to respond to them. Se-

lecting the first menu item brings up the standard Font dialog box. Selecting the second menu item brings up MyFontDlg, your (as yet unmodified) custom Font dialog box. In both cases the code requests a simple Font dialog without color or special effects options. Without these optional selections there is, of course, the noticeably empty space in the left corner of the dialog that can be seen in Figure 4. We'll take care of that by modifying the MyFontDlg dialog template.

Looking back at Figure 1, notice that there is a static control named "AaBbYyZz" that has the attribute NOT WS_VISIBLE. Even though this control is not displayed, its coordinates are used to indicate where the Font dialog code should display an example of the selected font. The caption of the hidden control is also used as the text of the sample font display. If the hidden control were to be

TEST1.RC

Complete Listing

```
#include "tpw\owl\wobjects.h"

MainMenu MENU
BEGIN
    POPUP "Select"
    BEGIN
        MENUITEM "&Standard ChooseFont", 101
        MENUITEM "&Modified ChooseFont", 102
        MENUITEM SEPARATOR
        MENUITEM "Exit", cm_Exit
    END
END

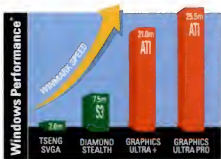
MyFontDlg DIALOG 10, 29, 225, 160
STYLE DS_MODALFRAME | WS_POPUP | WS_CAPTION | WS_SYSMENU
CAPTION "Font"
FONT 8, "Helvetica"
BEGIN
    LTEXT "Font:", 1088, 6, 3, 40, 9
    CONTROL "", 1136, "COMBOBOX", CBS_SIMPLE | CBS_OWNERDRAWFIXED | CBS_AUTOSCROLL | CBS_SORT | CBS_HASSTRINGS | WS_CHILD |
    WS_VISIBLE | WS_VSCROLL | WS_TABSTOP, 6, 13, 94, 54
    LTEXT "Font Style:", 1089, 108, 3, 44, 9
    CONTROL "", 1137, "COMBOBOX", CBS_SIMPLE | CBS_OWNERDRAWFIXED | CBS_HASSTRINGS | WS_CHILD | WS_VISIBLE | WS_VSCROLL |
    WS_TABSTOP, 108, 13, 64, 54
    LTEXT "Size:", 1090, 179, 3, 38, 9
    CONTROL "", 1138, "COMBOBOX", CBS_SIMPLE | CBS_OWNERDRAWFIXED | CBS_SORT | CBS_HASSTRINGS | WS_CHILD | WS_VISIBLE |
    WS_VSCROLL | WS_TABSTOP, 179, 13, 36, 54
    CONTROL "OK", 1, "BUTTON", BS_DEFPUSHBUTTON | WS_CHILD | WS_VISIBLE | WS_GROUP | WS_TABSTOP, 188, 76, 36, 14
    CONTROL "Cancel", 2, "BUTTON", BS_PUSHBUTTON | WS_CHILD | WS_VISIBLE | WS_GROUP | WS_TABSTOP, 188, 96, 36, 14
    CONTROL "Help", 1838, "BUTTON", BS_PUSHBUTTON | WS_CHILD | WS_VISIBLE | WS_GROUP | WS_TABSTOP, 188, 116, 36, 14
    CONTROL "Apply", 1826, "BUTTON", BS_PUSHBUTTON | WS_CHILD | WS_VISIBLE | WS_GROUP | WS_TABSTOP, 188, 136, 36, 14
    CONTROL "Sample", 1873, "BUTTON", BS_GROUPBOX | WS_CHILD | WS_VISIBLE | WS_GROUP, 8, 72, 164, 48
    CONTROL "AaBbYyZz", 1892, "STATIC", SS_CENTER | SS_NOPREFIX | NOT WS_VISIBLE | WS_CHILD | WS_GROUP, 14, 81, 152, 36
    CONTROL "", 1893, "STATIC", SS_CENTER | SS_NOPREFIX | WS_CHILD | WS_VISIBLE, 12, 130, 156, 20
    CONTROL "Effects", 1072, "BUTTON", BS_GROUPBOX | WS_CHILD | NOT WS_VISIBLE, 9, 180, 84, 34
    CONTROL "Strikethrough", 1040, "BUTTON", BS_AUTOCHECKBOX | WS_CHILD | NOT WS_VISIBLE, 13, 190, 49, 10
    CONTROL "Underline", 1041, "BUTTON", BS_AUTOCHECKBOX | WS_CHILD | NOT WS_VISIBLE, 13, 202, 51, 10
    CONTROL "Color:", 1091, "STATIC", SS_LEFT | WS_CHILD | NOT WS_VISIBLE, 9, 218, 30, 9
    CONTROL "", 1139, "COMBOBOX", CBS_DROPDOWNLIST | CBS_OWNERDRAWFIXED | CBS_AUTOSCROLL | CBS_HASSTRINGS | WS_CHILD | NOT
    WS_VISIBLE | WS_BORDER | WS_VSCROLL, 9, 228, 84, 100
    LTEXT "Though no longer visible, these controls must still be present in the dialog.", -1, 8, 172, 244, 8
    CONTROL "Notes", 1827, "BUTTON", BS_GROUPBOX | WS_CHILD | WS_VISIBLE, 8, 120, 164, 32
END
```

Figure 5: This resource script defines the menu for TEST1.PAS and the customized Font dialog, MyFontDlg.



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made visible it would paint over what the dialog box displays in the same area. And if the control were removed you would end up with no sample font display at all. There are thus two interesting things to note here. First, an invisible control is contributing valuable information to the dialog. And second, the dialog function draws on the space "occupied" by the invisible control without using an owner-draw message mechanism (such as is used with the custom list boxes and the combo boxes of this dialog box). We'll encounter these oddities again a little later on, but for now they're just artifacts we need to be aware of and preserve.

At this point, however, you're ready to edit the copy of FONT.DLG you made earlier and saved as TEST1.RC. You can change the screen coordinates of the hidden static control to another location in the MyFontDlg dialog box either with a resource editor or by manually editing the .RC script file. When you save this modified .RC script file, compile it into a .RES resource file (Resource Workshop can do both in one step), and then recompile the TEST1 program with the new resources, you'll see that the sample font display has moved with the relocated (but still hidden) static control. Figure 5 shows the resource script of the modified MyFontDlg dialog, and Figure 6 shows the resulting dialog box. Note that the sample font display area and the dialog buttons have been moved to the left, filling the void made by omitting the special effects controls.

What should be done with the special effects controls if you know that they'll never be used in your trimmed-down dialog box? Your first instinct is probably to delete them, but this is not a good idea. COMMDLG expects those controls to exist, and it will try to send messages to them in the course of initializing and painting the dialog box. Sending messages to controls that don't exist is not a capital offense, but it's bad form and should be avoided. Thus, even if unused in a particular custom dialog template, standard controls in common dialog boxes should not be deleted. Instead, you should simply push them off to one side, beyond the box frame, and strip them of group and tab-stop attributes. Controls so located will not be displayed, but they will still exist to satisfy COMMDLG.

It was at this stage of experimentation that we stumbled across one of those COMMDLG bugs mentioned earlier. If you open two differently customized Font dialog boxes, they will interfere with each other and cause the sample font display location of one dialog to be used by the other.

To see the problem, run the TEST1 program and pull up the MyFontDlg dialog box and leave it displayed, then switch to MS Write and bring up its Character Fonts dialog box and leave that displayed, and then switch back to the TEST1 program. You'll find that the sample font display in the test program's dialog is repainted in the wrong location. It gets painted at the location specified by Write's Font dialog box. It works the other way around, too: Write's Font dialog can be made to show its sample font in the wrong location. It would appear that there is some data sharing or crossover occurring in COMMDLG between different instances of the same kind of dialog box. The dialog templates are different, but the code that runs the show via COMMDLG.DLL is the same.

Microsoft confirms that this is a bug in COMMDLG.DLL and says it will be addressed in a future version of Windows or COMMDLG.DLL, but there is presently no available workaround. If users of your program encounter this bug you'll just have to tell them not to do that.

PHASE 2: AN OBJECT WRAPPER Modifying dialog templates is fairly simple. It's also fairly harmless, for about all you can do in a dialog box template is push the controls around without really changing the way the box behaves. If you want to add new controls to a dialog template, however, you must provide some code to process messages in order to make the new controls do something useful. The objects we'll build to simplify the data requirements of COMMDLG can also perform message processing and can thus bridge the gap between COMMDLG and your OWL programs.

Keep in mind that there are always two sides of an OWL window object. There is the window entity itself (the Windows window), to which you have

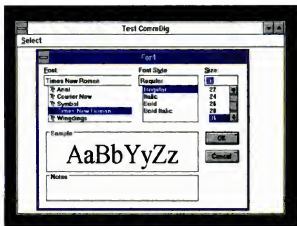


Figure 6: Customizing the Font dialog box by moving controls around in the dialog template results in a more space-efficient and less distracting design for this particular set of Font option settings. Only the appearance, not the functioning of the dialog box, has been changed.

limited access via Windows functions; and there is the OWL object in your program that represents the Windows entity in your object-oriented application. Don't forget, too, that while there is only one copy of an object type in a program (and only one copy of the code that goes with it), in your application there can be many simultaneously active instances of that object type. The instance is a unique combination of data plus shared code. The object type simply defines the layout of the unique data for each instance and the code shared by all instances.

COMMDLG allows a program to receive and process messages headed toward a common dialog box before COMMDLG's dialog function acts on those messages. To activate this feature you fill the lpfnHook field of the common dialog data structure with the address of an exported function in your program and then set a flag to indicate that you want to "hook," or tap into, the common dialog's messages. This hook function will be the bridge between COMMDLG and OWL.

If an OWL object is to control a common dialog box, the object needs access to the dialog's messages. As with other messages, COMMDLG's messages must be piped into the OWL message dispatcher so that the OWL object will receive them. Your first thought, then, might be to create an exported function that would copy messages received from COMMDLG into the OWL system. There is a much simpler way, however,

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if you consider how an OWL window object normally gets its messages; that is, via a function address unique to the object instance.

The hocus-pocus OWL goes through to make this happen is beyond the scope of this article. The essential fact, however, is simply that every window with a corresponding OWL object instance is given a message function address that uniquely associates the window with the instance. You can have two instances of a TWindow object type that are identical in all respects *except* for their two HWindow fields and their two windows message function addresses. The HWindow field in the object instance is used in Windows API calls that need a window han-

dle, thus letting the object "talk" to its window. The message function receives messages sent to the window and activates the corresponding object and method in your program, thus letting Windows talk to the object.

Of course, Windows knows absolutely nothing about the objects in your program; it is OWL's interaction with Windows that makes the two disjoint halves of the system appear to operate as one.

The unique message function address is stored in TWindowsObject.Instance, and it is initialized in TWindowsObject.Init. TWindowsObject is the ancestor of all OWL window and dialog objects, so all OWL window and dialog objects contain this Instance field. The

message function is good enough for general window and dialog messages, so it's good enough to handle COMMMDLG dialog messages as well.

Thus, all you need to do to get COMMMDLG's messages routed into your OWL object is to make the following assignment

```
lpfnHook := Self.Instance;
```

in the object's constructor, where lpfnHook is the field in the data structure of the common dialog you want to execute. This tells COMMMDLG to send the messages to the message function address that has been set up for the object instance. COMMMDLG messages can

UTEST2.PAS

Complete Listing

```
unit UTest2;

interface

uses winprocs, wintypes, wobjects, commdlg, windos, strings;

type
  TFileDlg = ^TFileDlg;
  TFileDlg = object(TDialog)
    OPN : TOpenFileName;
    constructor Init(AParent : PWindowsObject;
      AFlags : Longint;
      AFileName : PChar;
      ANameLength : Integer);
    destructor Done; virtual;
    function Create : Boolean; virtual;
    procedure Execute : Integer; virtual;
    procedure OK(var Msg : TMessage); virtual;
    procedure Cancel(var Msg : TMessage); virtual;
  end;

implementation

constructor TFileDlg.Init(AParent : PWindowsObject;
  AFlags : Longint;
  AFileName : PChar;
  ANameLength : Integer);
var
  TempName : array[0..fsFileName] of Char;
  TempExt : array[0..fsExtension] of Char;
begin
  TDialog.Init(AParent, nil);
  FillChar(OPN, SizeOf(OPN), 0);
  with OPN do
    begin
      IStructSize := SizeOf(OPN);
      hwndOwner := AParent^.hWindow;
      lpfnHook := Instance;
      Flags := AFlags or OPN_ENABLEHOOK;
      hInstance := System.hInstance;
      lpstrFileName := nil;
      nMaxFileTitle := 0;
      GetMem(lpstrInitialDir, Succ(fsDirectory));
      lpstrFile := AFileName;
      nMaxFile := ANameLength;
      lpstrFile := 'Open File';
      FileExpand(lpstrFile, AFileName);
      FileSplit(lpstrFile, lpstrInitialDir, TempName, TempExt);
      StrCat(StrCopy(lpstrFile, TempName), TempExt);
    end;
  end;

destructor TFileDlg.Done;
begin
  FreeMem(OPN, lpstrInitialDir, Succ(fsDirectory));
  TDialog.Done;
end;
```

```
function TFileDlg.Create : Boolean;
begin
  Create := False; { Cannot create a non-modal File Open dialog }
end;

function TFileDlg.Execute : Integer;
{ Basically, This is the code from TDialog.Execute with the call to
  DialogBoxParam changed to GetOpenFileName }
var
  CDError : Longint;
  OldKbHandler : PWindowsObject;
begin
  if Status = 0 then
    begin
      DisableAutoCreate;
      EnableKbHandler;
      IsModal := True;
      OldKbHandler := Application^.KbHandlerWnd;
      if GetOpenFileName(OPN) then
        Execute := id_ok
      else
        begin
          CDError := CommDlgExtendedError;
          if CDError = 0 then
            execute := id_Cancel
          else
            Status := -CDError;
            Execute := Status;
          end;
        end;
      Application^.KbHandlerWnd := OldKbHandler;
      Hwndown := 0;
    end
  else
    Execute := Status;
  end;

procedure TFileDlg.OK(var Msg : TMessage);
{ COMMMDLG requires that the hook function (i.e. this method) does NOT
  call EndDlg() for it's modal dialogs. Setting Msg.Result to 0 will
  allow COMMMDLG to terminate the dialog. A value of 1 will cause
  COMMMDLG to ignore the OK button press. }
begin
  if CanClose then
    Msg.Result := 0
  else
    Msg.Result := 1;
end;

procedure TFileDlg.Cancel(var Msg : TMessage);
begin
  Msg.Result := 0;
end;
```

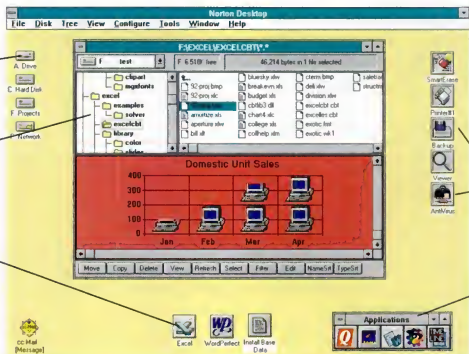
Figure 7: TFileDlg is an OWL object that interfaces with and processes messages for the Open File common dialog.

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now be processed in object methods, as with any other OWL window object.

SPECIAL MESSAGE REQUIREMENTS

COMMDDLG imposes special handling requirements for some Windows messages. The WM_INITDIALOG message is an exception to the rule that all messages will be sent to the object before COMMDDLG processes them. COMMDDLG does some initialization before that specific message is passed on to your object. This doesn't affect OWL in the least, but it's good to know if you're playing around with WM_INITDIALOG response code.

The other important special case is the EndDlg procedure. Normally, when you get an OK button click or Cancel or some other action that should close the dialog, you would call EndDlg to terminate the dialog's modal state and return a value to the code that executed the dialog. Because COMMDDLG needs to process messages leading up to and including dialog termination, EndDlg should not be used to close a common dialog box. If the message is one that will automatically terminate the dialog (for example, the OK or Cancel button click), your code can simply ignore the message and let COMMDDLG terminate itself. If the message is not one that will cause Windows to terminate the dialog but you want to close the dialog when you receive that message, you can post a message to the dialog box thus:

```
PostMessage(Self.HWindow, wm_Command,
IDABort, ReturnValue)
```

The IDABort command message tells COMMDDLG to close the dialog box and to pass ReturnValue as the dialog's exit code.

Naturally, the default method used by an OWL TDialog object to end the modal state of a dialog box is to call EndDlg. Therefore, in your TFileDialog object this method must be overridden to comply with COMMDDLG's special EndDlg-avoidance requirements.

UTEST2.PAS, the source code for TFileDialog, is listed in Figure 7. At the top of the unit is the object type declaration. Descended from the OWL TDialog object, TFileDialog defines a new data field and overrides several methods inherited from TDialog.

The only data field of the TFileDialog object is OFN, a TOPENFILENAME record that the object will initialize and pass to COMMDDLG's GetOpenFileName function. Some fields in the record OFN are pointers to buffers, and these buffers will be allocated and disposed of completely within the object.

Most of the object's work occurs in the Init constructor, which initializes the many fields of the OFN record. The constructor takes four parameters: a pointer to the parent window object, a variable for option flags, a pointer to the filename buffer, and the size of that buffer. After the inherited constructor is called, the OFN record is zeroed out and selected fields are initialized to configure the various dialog options and string buffer pointers. Note that any fields in the OFN record that are not explicitly assigned a value are zeroed to avoid confusing COMMDDLG with garbage data.

The AFlags parameter is copied into the OFN.Flags field, and the OFN_ENABLEHOOK bit flag is set. This particular combination will allow you to specify special OFN option flags while constructing the dialog object. It will also allow the dialog object to receive and process messages by way of the COMMDDLG hook. The lpfnHook field is assigned the object's Instance message function address.

For now, however, we're not to the point of providing a complete custom dialog template; we're simply building the TFileDialog object that will control and process messages for the common dialog box. In the second part of this article, we'll combine template customization with object-oriented control.

The FileSplit and FileExpand function calls in the constructor are there to split the directory portion of the filename parameter from the filename and extension portions. The FileOpen dialog is

thus able to initialize the filename list box based on the directory portion and to put only the filename and extension in the filename edit control. If the directory were not split from the lpstrFile field, the list box would not be initialized and the edit control would get the fully qualified filename, which would not be attractive. The memory allocated for lpstrInitialDir is disposed of by the object's Done destructor.

TFileDialog.Create is overridden so as always to return FALSE, which means that this dialog box can only be created as a modal dialog. Non-modal dialogs are created via their Create method; modal dialogs are created and executed via their Execute method. Since COMMDDLG supports only a modal FileOpen dialog, so should our object.

TFileDialog.Execute is essentially a copy of TDialog's Execute method, except that where TDialog.Execute would call the API function DialogBox to display the dialog, TFileDialog instead calls COMMDDLG's GetOpenFileName function. The COMMDDLG error status is recovered after the box is closed. The OK and Cancel methods avoid using EndDlg to terminate the common dialog, as discussed above.

This simple TFileDialog object can be plugged into an OWL application with the few lines of code shown in Figure 8. All that is needed is a filename buffer containing an initial file mask to pass to the TFileDialog constructor. You don't have to retain a pointer to the dialog object; all you need to do is allocate the object instance dynamically with New and send the pointer directly to Application.ExecDialog. ExecDialog will verify that the dialog was correctly initialized and then call the dialog's Execute method. Once TFileDialog.Execute has handed control over to COMMDDLG's

How to Add a TFileDialog Object

```
procedure TMyMainWindow.cmFileOpen(var Msg: TMessage);
var
  FileName: array [0..79] of Char;
  Result: Integer;
begin
  StrCopy(FileName, '*.pas');
  Result := Application.ExecDialog(new(TFileDialog,
    Init(Self, OFN_FileMustExist, FileName, SizeOf(FileName))));
  if Result = idOK then
  end;
```

Figure 8: With these few lines of code, you can add your TFileDialog object to an OWL application.

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TEST2.PAS

Complete Listing

```

program Test2;
uses winprocs, wintypes, wobjects, strings, commdlg, TTest2;

{$R Test2}

type

  TMyApp = object(TApplication)
    procedure InitMainWndow; virtual;
  end;

  TMyMainWndow = ^TMyMainWndow;
  TMyMainWndow = object(TMDIWindow)
    procedure cmFileOpen(var Msg: TMessage); virtual;
  end;

  procedure TMyMainWndow.cmFileOpen(var Msg: TMessage);
  var
    FileName: array [0..79] of Char;
    Result: Integer;
  begin
    StrCopy(FileName, '.pas');
    Result := Application^.ExecDialog(new(TFileDlg,
      Init(Self, OFN_FileMustExist, FileName, SizeOf(FileName))));
    if Result = idOK then
      MessageBox(HWND, FileName, 'You selected', mb_OK);
    end;

    procedure TMyApp.InitMainWndow;
    begin
      MainWndow := new(TMyMainWndow, Init('Test CommDlg',
        LoadMenu(HInstance, 'MainMenu')));
    end;

    var MyApp: TMyApp;
    begin
      MyApp.Init('TestCommDlg');
      MyApp.Run;
      MyApp.Done;
    end.
  end;

```



Figure 8: This short program shows how little code is needed to invoke an Open File common dialog using the new TFileDlg object.

startup function, your work is over. When the dialog terminates, ExecDialog will dispose of the dialog object and your filename buffer will contain the user's selection.

TEST2.PAS (listed in Figure 9) and TEST2.RC (Figure 10) constitute a simple OWL application that responds to a File, Open menu selection by creating and executing a TFileDlg object. You may find it instructive to note the difference in the amount and complexity of the code required to set up the TFileDlg object (shown in Figure 8) and that needed to set up the TOpenFileName data structure in the TFileDlg.Init Constructor (Figure 7).

The TFileDlg.Init constructor con-

tains about 20 lines of assignments and operations. These would be required every time your program wanted to use the FileOpen common dialog. Compare that 20 to the 4 lines of code that are required to set up and execute the TFileDlg dialog. In terms of machine code, those 20 lines of initialization are still performed, but they are performed inside the object. The programmer who uses the TFileDlg object need only be concerned with the 4 lines of code required to execute the object. This is an example of the greater simplicity we have been seeking.

By constructing even more complex file dialog objects you could, for example, support multiple-selection file dialogs automatically. The test for whether it is desirable to do so is simple: The steps required of the programmer to invoke such an object should always be fewer than the steps needed to perform the equivalent action directly.

Greater simplicity is only one of the benefits a TFileDlg object can provide. Another is that by routing all the common dialog's messages through your object you gain a great deal of control over the seemingly inaccessible common dialogs. The TEST2 sample program above simply scratches the surface of this potential power benefit.

The code examples I've used in this article were extracted from an extensive OWL object layer for COMMDLG dialogs written by Pat Ritchey. This object layer includes support for standard

COMMDLG dialogs, BWCC versions, and programmer-supplied dialog templates. The full source code, an extensive demo program, and the COMMDLG.PAS interface unit are available for downloading as LN1119.ZIP from Library 2 (PCMag Utils) of the Utilities/Tips Forum on PC MagNet. This code can be compiled with TPW 1.0 (non-BWCC), TPW 1.0 with WObjectB, and TPW 1.5 with integrated BWCC support. The COMMDLG.PAS interface unit can also be found in TPW 1.5. If you don't have access to PC MagNet, you can get the complete source code and executables by sending a postcard with your name, address, and preferred disk size to the attention of Katherine West, Lab Notes, PC Magazine, One Park Ave., New York, NY 10016. Or fax your request to 212-503-5799.

At this point, we've covered the first two levels of customizing the common dialogs: customizing dialog templates and hooking OWL objects into COMMDLG.DLL. In the next issue, we'll combine these techniques to redecorate the common dialogs with Borland's "chiseled steel" background and bitmapped dialog controls. □

DANNY THORPE IS A QUALITY ASSURANCE ENGINEER at BORLAND INTERNATIONAL. PAT RITCHEY IS PRESIDENT OF O'NEIL TENTS INC., AND AN ACTIVE MEMBER OF TEAM BORLAND IN BORLAND'S PROGRAMMING FORUMS ON COMPUSEVE.

TEST2.RC

Complete Listing

```

#include <tpw\owl\wobjects.h>

MainMenu MENU
BEGIN
  POPUP 'File'
  BEGIN
    MENUITEM '&Open', 101
    MENUITEM SEPARATOR
    MENUITEM '&Exit', cm_Exit
  END
END

```

Figure 10: The only resource used by the TEST2.PAS program is its main menu. Although the TFileDlg object in the TEST2 sample does not change the appearance of the Open File dialog, it gives your OWL program a way of accessing, controlling, and extending the common dialog box's behavior.



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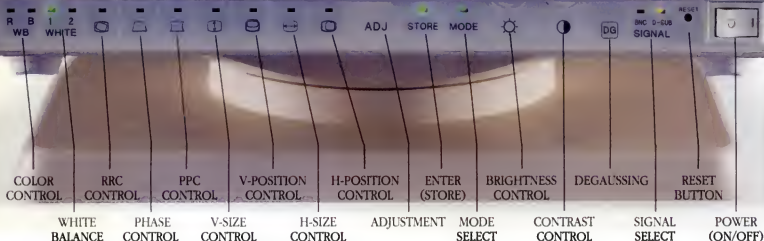
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Saving Your Music In a MIDI File

BY CHARLES PETZOLD

For the past several issues, we've been preparing to tackle a program that reads MIDI messages generated by a MIDI keyboard or other MIDI controller and saves them in a MIDI file. Such a program would let you create a MIDI file simply by playing music on a keyboard. The preparation for writing this program has involved learning how to use the low-level MIDI input functions supported under Windows 3.1 and becoming familiar with the industry-standard MIDI file format.

Of course, there are commercial MIDI sequencing programs that do precisely this. Several of them were reviewed in the March 31, 1992, issue of *PC Magazine* in the article "MIDI Goes Mainstream." These programs also allow (among other features) editing the MIDI sequences on-screen after you've recorded them, giving you the ability to fix any mistakes you may have made while playing the music on the keyboard.

I knew I wouldn't be able to implement editing in a small program, but what I did want to accomplish was the capability to record several tracks of information. For instance, you'd begin by playing something on the keyboard, saving all the MIDI messages in memory. That would be the first track. Then you'd play back these MIDI messages while playing the keyboard again, probably using a different instrument voice. Now you'd have two tracks. In this way, you could progressively build up an entire composition.

That's what I wanted to do. But as deadlines loomed and the size of this project became more apparent to me, I decided to take a much less ambitious approach. The program presented here, called MIDFIL (MIDI file with the file-

name shortened to the six-character CompuServe maximum), allows recording only one track. So you have to play the whole composition in one shot. You then have the option of either saving it to a MIDI file or redoing it.

MIDFIL is too long to print in its entirety, but you can download the source code and the executable (including the required MIDBUF.DLL file) from PC

*Our sample program lets
you record a musical
composition played on
a MIDI keyboard,
then store the music
in a MIDI file.*

MagNet archived as MIDFIL.ZIP.

USING MIDFIL MIDFIL is built upon the MIDREC (MIDI record) program I discussed in the September 15, 1992, Environments column. MIDREC has a simple dialog-box window with five buttons. You use two buttons—Record and End—to begin and end the recording of MIDI messages from a keyboard. The program stores MIDI messages in memory in a very simple format, consisting of alternating 32-bit delta times in milliseconds and MIDI messages packed into 32-bit values. Three buttons—Play, Pause, and End—let you play back the MIDI sequence. A Devices menu lets you choose the MIDI devices used for input, output, and monitoring the music while you played it.

MIDREC uses the MIDBUF dynamic

link library discussed in the August 1992, installment of this column. MIDBUF simplifies using low-level MIDI input and output from an application. When recording, MIDBUF.DLL stores millisecond delta times and MIDI messages in buffers that are also used by MIDBUF for playback.

If you know how to use MIDREC, MIDFIL should be a snap. The user interface consists of one additional button labeled Save. After you record a sequence, you can press this button to invoke a File Save dialog box. Enter a filename, and the program converts the MIDI sequences in the memory buffers to the format required for a MIDI file. You can then play this file using the Windows 3.1 Media Player program or the MIDPLA program I presented in the October 13, 1992, issue.

When you record a sequence using MIDFIL, set up your keyboard to output all messages on MIDI channels 0, 1, or 2 and begin by pressing one of the instrument-voice buttons to generate a Program Change message. MIDFIL duplicates messages on channels 0, 1, and 2 for channels 12, 13, and 14 so the file will also be playable on a base-level synthesizer. (I'll discuss this feature in more detail later.)

As I mentioned, MIDFIL uses much of the code from MIDREC. To display the File Save dialog box, MIDFIL uses the Windows 3.1 Common Dialog Box Library; both Ray Duncan and I have discussed the common dialog boxes in earlier columns.

THE NEW CODE The most significant additions to MIDREC's code that turned it into MIDFIL are, of course, the functions that took the data in the buffers and converted them into the format required

for MIDI files. These functions are shown in Figure 1.

As you'll recall, MIDREC (and hence, MIDFIL) stores the incoming MIDI data using a linked list of MIDIHDR structures. Three fields of the MIDIHDR structure are important for our use. The lpData field is a pointer to a buffer containing the actual MIDI data. This data is stored as alternating 32-bit double words (delta times and packed MIDI messages). This is how MIDBUF.DLL stores the MIDI data.

The dwBufferLength field is the length of the buffer in bytes. This buffer length can range from 8 bytes (one delta time and one MIDI message) to 4,096 bytes (512 delta times and MIDI messages). All buffers except the last will have 4,096 bytes.

The linked list is maintained using the MIDIHDR structure's dwUser field. A pointer to the first MIDIHDR structure is stored in the program in a static variable called pMidiHdrRoot. The dwUser

field of that MIDIHDR structure contains a pointer to the next MIDIHDR structure, and so on. The end of the chain is indicated by a NULL value in the dwUser field.

STARTING OFF The function called SaveMidiFile in Figure 1 has just two parameters passed to it—the fully qualified filename obtained from the File Save dialog box and a pointer to the root MIDIHDR structure. The function first attempts to create the file by calling the Windows function _lcreate. If unsuccessful, the function returns FALSE and the MIDFIL program displays a message box to the user that it could not save the file.

As you'll recall, MIDI files begin with a header chunk followed by one or more track chunks. I decided to use just one track chunk in the files saved by MIDFIL and to hard-code the header chunk. The pHeader variable defined in SaveMidiFile contains the header chunk and the first 8 bytes of the track chunk.

The header chunk defined in the

pHeader array begins with the four characters MThd followed by the size of the header chunk, which is always 6 bytes. This is followed by a 16-bit value of 0 (indicating a one-track MIDI file), a 16-bit value of 1 (indicating one track), and the two numbers -25 and 40 (in decimal). The first number indicates that the file uses a SMPTE format of 25 frames per second. (Each frame is thus 40 milliseconds long.) The second number is the division of each frame. By setting this to 40, all delta times in the file can be conveniently expressed in milliseconds. The pHeader array also contains the four characters MTrk to indicate the track chunk, followed by 4 zero bytes that will eventually indicate the size of the track chunk. After creating the file, SaveMidiFile calls _lwrite to write out the MIDI header chunk and the first 8 bytes of the track chunk.

In preparation for looping through the chain of MIDIHDR structures, SaveMidiFile sets the variable pMidiHdr to

THREE MIDI FUNCTIONS

1 of 2

```
// Functions to save the MIDI data buffers as a .MID file
// -----
int VarLenNumOut (BYTE * pOut, int iOut, long lAbsTime)
{
    long lVarTime;

    lVarTime = lAbsTime & 0x7F;

    while ((lAbsTime >>= 7) > 0)
    {
        lVarTime <<= 8;
        lVarTime |= 0x80;
        lVarTime += lAbsTime & 0x7F;
        lAbsTime >>= 8;
    }

    while (TRUE)
    {
        pOut[iOut++] = (char) lVarTime;

        if (lVarTime & 0x80)
            lVarTime >>= 8;
        else
            break;
    }

    return iOut;
}

long IntelToMotorolaLong (long lIn)
{
    long lOut;

    * ( (char *) lOut + 0 ) = * ( (char *) lIn + 3 );
    * ( (char *) lOut + 1 ) = * ( (char *) lIn + 2 );
    * ( (char *) lOut + 2 ) = * ( (char *) lIn + 1 );
    * ( (char *) lOut + 3 ) = * ( (char *) lIn + 0 );

    return lOut;
}

BOOL SaveMidiFile (char * szFileName, LPMIDIHDR pMidiHdrRoot)
{
    static BYTE pbuOut [2 * BUFFER_SIZE];
    static BYTE pHeader [] = { 'M', 'T', 'h', 'd', 0, 0, 0, 6,
                                0, 0, 1, -25, 40,
                                'M', 'T', 'r', 'k', 0, 0, 0, 0 };
    static BYTE pEndTrk [] = { 0, 0xFF, 0x2F, 0x00 };
    BYTE bStatue, bChannel, bDate1, bDate2;

    DWORD dwTime, dwMidiMsg;
    int hFile, iLenIn, iIn, iOut;
    long lTotLen;
    LPMIDIHDR pMidiHdr;
    LPDWORD pbuBufIn;

    // Attempt to open the file
    if (! (hFile = _lcreate (szFileName, 0)))
        return FALSE;

    // Write out the header chunk and some of the track chunk
    _lwrite (hFile, pHeader, sizeof (pHeader));

    // Loop through the MIDIHDR chain
    pMidiHdr = pMidiHdrRoot;
    lTotLen = 0;

    while (pMidiHdr != NULL)
    {
        iLenIn = (int) pMidiHdr->dwBufferLength / 4;
        pbuBufIn = (LPDWORD) pMidiHdr->lpData;
        iOut = 0;

        // Loop through the DWORDs in the buffer
        for (iIn = 0; iIn < iLenIn; iIn += 2)
        {
            // Get the delta time in milliseconds
            dwTime = pbuBufIn [iIn];

            // If it's the very first, set it to zero
            if (pMidiHdr == pMidiHdrRoot && iIn == 0)
                dwTime = 0;

            // Store it as a variable length number
            iOut = VarLenNumOut (pbuBufIn, iOut, dwTime);

            // Get the MIDI message
            dwMidiMsg = pbuBufIn [iIn + 1];

            bStatue = LOWBYTE (LOWORD (dwMidiMsg));
            bDate1 = HIGHBYTE (LOWORD (dwMidiMsg));
        }
    }
}
```



Figure 1: These three functions in MIDFIL.C handle the conversion of buffers to the MIDI file format.



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THREE MIDFIL FUNCTIONS

2 of 2

```

bData2 = LOBYTE (HIMWORD (dwMidiMsg));

// Forget about system messages

if (bStatus == 0xF0)
    continue;

// Store the status byte and first data byte

pBufOut[iOut++] = bStatus;
pBufOut[iOut++] = bData1;

// For three byte messages, store the
// second data byte

if (bStatus < 0xC0 || bStatus == 0xE0)
    pBufOut[iOut++] = bData2;

// Get the channel number

bChannel = bStatus & 0x0F;

// If it's not mappable, continue with next loop

if ((bChannel > 2 && bChannel < 9) ||
    (bChannel > 9 && bChannel < 12))
    continue;

// Map the channel and create a new status byte

if (bChannel < 3)
    bChannel += 12;

else if (bChannel == 9)
    bChannel = 15;

else if (bChannel == 15)
    bChannel = 9;

else if (bChannel > 11)
    bChannel -= 12;

bStatus = (bStatus & 0xF0) | bChannel;

// Store & delete time of zero

pBufOut[iOut++] = 0;

// Store the MIDI message as above

pBufOut[iOut++] = bStatus;
pBufOut[iOut++] = bData1;

if (bStatus < 0xC0 || bStatus == 0xE0)
    pBufOut[iOut++] = bData2;

// Write out the buffer

if (iOut != (int) _lwrite (hFile, pBufOut, iOut))
{
    _lclose (hFile);
    unlink (szFileName);
    return FALSE;
}

// Increment the total track size

lTotLen += iOut;

// Get next MIDIHDR structure in chain

pMidiHdr = (LPMIDIHDR) pMidiHdr->dwUser;
}

// Store an "end of track" meta-message

_lwrite (hFile, pEndTrk, sizeof (pEndTrk));

lTotLen += sizeof (pEndTrk);

// Convert track length to Motorola format and store it
// in the size field of the track chunk

lTotLen = IntelToMotorolaLong (lTotLen);

_lseek (hFile, 18, 0);
_lwrite (hFile, &lTotLen, sizeof (long));

// Close the file

_lclose (hFile);

return TRUE;
}

```

the address of the root structure, and lTotLen to 0. This variable is used to accumulate the total data size of the track.

For each MIDIHDR structure in the chain, SaveMidiFile accesses all the delta times and MIDI messages in the buffers, converts them into the format required in the MIDI file, and saves the converted data in another buffer. These buffers are then written to the file. To pass the data from one buffer to the other, SaveMidiFile sets the variables iLenIn (the number of 32-bit integers in the buffer) and pdwBufIn (an address of the buffer as an array of 32-bit double words). The converted data will be stored in the array pBufOut, indexed by the variable iOut, which is initialized to zero.

SaveMidiFile then loops through all the double-word pairs in the buffer. The first double word is the delta time in milliseconds. This must be converted to a variable-length delta time to be stored in the pBufOut array. (The variable-length format was discussed in the last issue.)

CONVERTING TO VARIABLE LENGTH The function that converts an absolute 32-bit delta time to the variable-length format is VarLenNumOut, also shown in Figure 1. This conversion routine was derived from sample code shown in the "Standard MIDI Files 1.0" documentation distributed by the International MIDI Association. Let's see how this function works. We'll assume that the delta time in milliseconds is the 32-bit value 0x000186A0 (100,000 in decimal). This is passed to the VarLenNumOut function as the parameter lAbsTime.

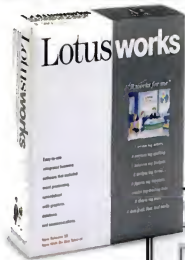
The variable lVarTime is first set to the bottom seven bits of lAbsTime, or 0x20. In the while statement, the lAbsTime value is then shifted right seven bits, to yield 0x030D. This is greater than zero, so the body of the while loop is executed. The lVarTime variable is shifted left eight bits (yielding 0x2000), then ORed with 0x80 (yielding 0x2080), to which the bottom seven bits of lAbsTime are added (yielding 0x208D).

The lAbsTime variable is then shifted right seven bits again, now equaling 0x06. This is greater than zero, so the body of the while loop is executed again. The lVarTime variable is shifted left eight bits (yielding 0x208D00) and ORed with 0x80 (yielding 0x208D80), to which the bottom seven bits of lAbsTime are added (yielding 0x208D86). Shifting lAbsTime seven bits right makes it zero and the function falls out of the first while loop.

The lVarTime value now equals 0x00208D86. The second while loop stores this as three eight-bit values in the output buffer from the bottom up, as 86 8D 20. This is one of the variable-length values used as an example in the last issue. The function increases the array index (iOut) and returns the new value of iOut back to the caller.

STORING THE MIDI MESSAGES Back in SaveMidiFile, the function must now handle the MIDI message. These are stored in the input buffer as packed 32-bit values. The status byte is the least sig-

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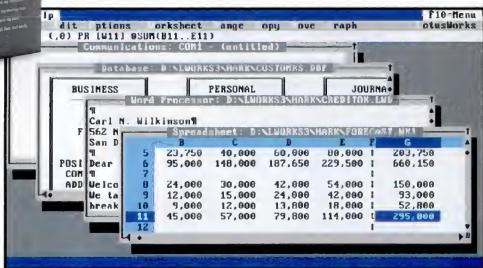
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nificant byte, the first data byte is the next highest, and the second data byte (if present) is next. The high byte is always zero.

All status bytes in MIDI messages have the high bit set, so they range from 0x80 through 0xFF. SaveMidiFile skips over system messages, which have status bytes of 0xF0 through 0xFF. MIDI messages with status bytes of 0x80 through 0xBF and 0xE0 through 0xEF have two data bytes, while those with status bytes of 0xC0 through 0xDF have one data byte. SaveMidiFile stores the status byte and one or two data bytes, depending on the message.

You'll recall that MIDI files designed for Windows 3.1 should contain two complete renditions of the music, one for extended synthesizers and the other for base-level synthesizers. Extended synthesizers use MIDI channels 0 through 8 for melodic voices and channel 9 for percussion; base-level synthesizers use MIDI channels 12 through 14 and channel 15 for percussion.

To accommodate this, SaveMidiFile duplicates the MIDI messages. Messages for channels 0, 1, 2, and 9 are converted to channels 12, 13, 14, and 15 respectively, and vice versa. The converted MIDI messages are stored with a delta-time of zero.

FINISHING UP When an input buffer has been entirely converted, the output buffer is written to the file and the length of the output buffer is accumulated in the ITotLen variable. SaveMidiFile then obtains the next MIDIHDR in the chain and begins again. After finishing with all the buffers, SaveMidiFile writes out an "end of track" meta-message. This consists of the 3 bytes 0xFF, 0x2F, and 0x00, preceded by a delta time of zero.

At this time, the entire length of the track data is in the variable ITotLen; it must be stored 18 bytes from the beginning of the file. But before it's stored, the value must be converted from Intel byte ordering to Motorola byte ordering. This is done in the function IntelToMotorolaLong, also in Figure 1. The function simply flips the ordering of the bytes. SaveMidiFile stores the inverted track length, closes the file, and it's done.

IF YOU CAN'T PLAY WELL... Electronic music got its start in the 1950s, but it wasn't until the late 1960s (with the introduction of the Moog synthesizer) that

composers and performers could actually sit down at keyboards and record something on tape recorders. One famous record album using the Moog—the one that initiated my enduring interest in electronic music—was Wendy Carlos's *Switched-On Bach*, released by CBS Records in 1968. (Wendy Carlos recently re-recorded all the material from that first album to create *Switched-On Bach 2000*. Now, of course, she's using computers and MIDI synthesizers!)

Some of the terminology used back in those days can still be heard, though it sounds a bit anachronistic. You'll sometimes hear old-timers speak of instrument voices as *patches*. This term originated from using patch cords to connect the various oscillators, envelope generators, and filters of an analog synthesizer to create a unique instrument sound.

The term *tracks* used in MIDI files also originates from those days and refers to the tracks of a multitrack tape recorder. When Wendy Carlos recorded the original *Switched-On Bach*, the Moog synthesizer could only play one patch at a time. Each instrument had to be recorded individually. One track would be recorded on the tape recorder, and then the synthesizer had to be repatched. After the playback of the first track, second and subsequent tracks could be recorded, gradually building up the composition. I mention this because I was recently reminded of a little trick used quite frequently back in those days. The tape recorders in use could generally record at two speeds—7.5 inches per second and 15 inches per second. It was possible to record a track at 7.5 inches per second at half the tempo and one octave lower in pitch. Then, when you played it back at 15 inches per second, the frequency and tempo would be doubled. This allowed the finished product to sound as if you played much better and faster than you actually could!

I haven't included a facility in MID-FIL to do this, but you'll find it fairly easy to modify the MIDI file yourself. If you record a composition at half the tempo (don't play it an octave lower!), you can double the speed of the MIDI file by changing just one byte: the division value in the header. It's at offset 0x000D in the file. Change it from 0x28 to 0x50 to double the speed of the playback. □

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POWER PROGRAMMING

Memory Management and Mapped Files in Win32

BY RAY DUNCAN

The segmented architecture of Intel 80x86 microprocessors has been the target of much scorn by aficionados of RISC or 680x0 CPUs, but this derision is largely undeserved. The Intel protected-mode memory architecture, wherein a virtual address is composed of a handle (selector) and an offset, is an excellent substrate for a robust, multitasking environment, because it allows processes to be built out of memory "objects" that can be shared or segregated as distinct units without regard to their location in physical memory. Moreover, the critics conveniently ignore the segmentation in their own backyards: Some RISC processors (such as the original IBM "America" RISC CPU) are burdened with segmentation under another name, while Macintosh applications are constructed from code resources that are not allowed to exceed 32K.

The real problem with segmentation on Intel processors was not so much that it existed, but that segments were limited to 64K. Because of this, the address arithmetic in large 80x86 programs with code or data spanning multiple segments was very complicated, and the performance of such large programs was correspondingly poor.

When Intel designed its 80386 processor, segments were redefined in a way that allowed them to grow to 4GB, but this introduced a new problem: Segment-based virtual memory management was no longer feasible. Imagine a program's execution being suspended for several seconds or more while a segment of several megabytes was read in from the swap file, just to let the program access a single variable in that segment! Consequently,

Intel added another layer of virtual-memory management: the hardware paging unit.

When an Intel 80386 or 80486 is running in protected mode with paging enabled, there are two layers of virtual address translation. The selector and offset visible at the programming level are converted by the hardware segmentation unit—with the aid of descriptor tables

cal memory in nice, uniform, 4K chunks.

One of the interesting aspects of the two-tiered virtual memory management architecture of the 80386 and 80486 is that it can readily mimic the flat 32-bit memory model of CPUs like the Motorola 68040 and the VAX. You can't ever disable segmentation on an Intel processor—segment registers must always be loaded with valid selectors—but you can choose to ignore it. This is accomplished very simply by creating two descriptors, one for code and one for data, each mapping to the same giant memory segment at linear addresses 0 to 4GB. Application code is mapped to addresses at the bottom of the segment, and operating system code to addresses at the top of the segment (see Figure 2). The CPU's segment registers are loaded with the code or data selector as appropriate when the system starts up and is never touched again. All memory references, jumps, and calls are near; memory allocation, swapping, segregation of code from data, protection of operating system code, and the separation of one process's address space from another are all handled by manipulation of the page tables and page directory. Both OS/2 2.0 and NT/Win32 use this flat-memory model when running 32-bit applications.

Why did the designers of OS/2 2.0 and NT/Win32 decide to forgo the significant benefits of the segmented paged-memory model and adopt the flat model with its much smaller virtual address space? The reasons are partly economic and partly technical. From an economic standpoint, there are many expensive, exotic, hardware-hungry applications currently available only on workstations or supermini-computers. IBM and Microsoft hope to make porting of those applications to

*A look at the evolution
of memory management in
Windows, especially the
new mapped-file functions
designed for the 32-bit flat,
paged memory model.*

that are maintained by the operating system—into a 32-bit linear address. The linear address, in turn, is remapped by the hardware paging unit with the aid of page tables and a page directory (again maintained by the operating system) onto a 32-bit physical address identifying a 4K page of RAM and an offset within that page, as shown in Figure 1. The result is a 64-terabyte virtual address space superimposed on a 4GB physical address space.

As you can see, interposing a paging layer eliminates nearly all of the problems with segmented memory. Every application can be a "small" model, with a single, pure, shareable code segment and an instance data segment ranging in size from 1 byte to 4GB—while the operating system is free to allocate and swap physi-

Addressing Memory Using Page Tables

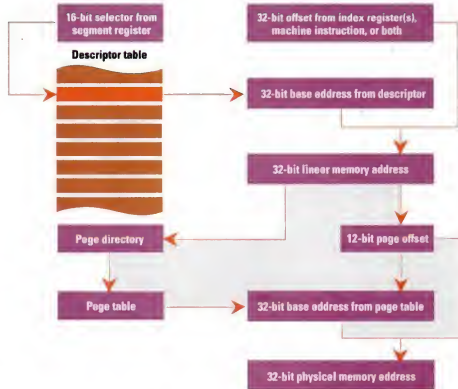


Figure 1: Memory addressing in 32-bit protected mode on the Intel 80386 and 80486 processors. The virtual address seen at the machine-code level, composed of a selector and offset, is translated by the hardware segmentation unit into a 32-bit linear address. The linear address is converted by the hardware paging unit into a 32-bit physical address.

OS/2 2.0 and NT/Win32 easier—and consequently much more attractive—by hiding segmentation (incidentally opening up a new and far less price-sensitive market for systems software that until now has been the exclusive province of companies like Sun, Hewlett-Packard, and Silicon Graphics).

The technical reason for this decision is that Microsoft and IBM are hedging their bets on the future of the microprocessor marketplace. Although the Intel 80x86 processors still dominate the installed base and their performance has improved dramatically with each successive generation, there is no guarantee that the Intel 80x86 architecture won't simply run out of steam. By abandoning segmentation, Microsoft and IBM have simplified the task of porting OS/2 or NT and their applications to other, non-Intel processors.

THE WIN32 MEMORY MANAGEMENT API

For an experienced Windows programmer who has thought about the underlying memory models, converting a 16-bit

Windows application for Win32/NT is a rather spooky business. The fundamental Windows memory management API—GlobalAlloc(), GlobalLock(), GlobalReAlloc(), GlobalUnlock(), GlobalFree()—was originally designed for the paragraph-oriented, based-addressing architecture of the Intel 8086 real mode. It survived the transition to the Intel 80286's 16-bit protected mode quite gracefully with the substitution of selectors for handles or paragraph addresses. But source code that was written for the 16-bit Windows memory API (Win16) compiles and runs fine on a MIPS R4000 RISC CPU running Win32/NT even though the MIPS processor has no selectors at all! How can this be? This is information hiding with a vengeance!

Most of the portability between the Win16 and Win32 memory models and APIs is accomplished at the source code level with TYPEDEFS and #DEFINEs in the Windows header files. Far memory references, far pointers, and far jumps or calls are transformed cheerfully and si-

lently to 32-bit near equivalents by the simple expedient of redefining FAR as a no-op. All data types (such as LPSTR) that are built on top of the FAR keyword with TYPEDEFS thus collapse to near data types by default. Similarly, function prototypes that were previously declared with the FAR keyword or with FAR-based TYPEDEFS as being entered through far calls and exited through far returns devolve automatically to near functions. The arguments and results of the Windows memory management functions are affected by these redefinitions like everything else.

For example, in Windows 3.x, the function GlobalLock() accepts a 16-bit handle and returns a selector and offset, while in Win32 the same function accepts a 32-bit offset and returns the same 32-bit offset. (In other words, in Win32 the function does absolutely nothing.) In both environments, GlobalLock() is prototyped as:

```
LPVOID WINAPI GlobalLock (HANDLE)
```

The differences in the underlying memory models are hidden from the application within the definitions of the LPVOID, HANDLE, and APIENTRY data types (as shown in Figure 3).

Another implication of this disappearance of far pointers in Win32 is that the Localxxx Windows API functions become mere aliases for their Globalxxx counterparts. The fact that this informa-

The Flat-Memory Model

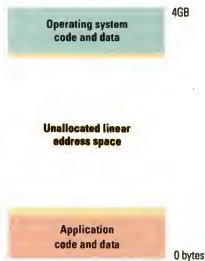
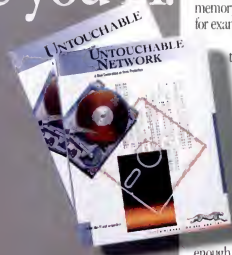


Figure 2: The flat-memory model of OS/2 2.0 and NT/Win32 on Intel 80386 and 80486 processors.

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Data types in Win16 and Win32

Data type	Win16	Win32
LPVOID	void far * (32-bit pointer)	void * (32-bit pointer)
HANDLE	unsigned int (16-bit value)	unsigned int (32-bit value)
APIENTRY	far pascal	_stdcall

Figure 3: For the GlobalLock() function, the differences in underlying memory models is hidden within the definitions of these data types.

tion hiding actually works and protects the existing Windows application source code base so effectively is one of the happiest events of microcomputing history. Certainly, when you consider that the basic Windows memory management API was created before the 80386 was even designed and RISC processors were still a laboratory curiosity, the API's adaptability to such an extreme variety of environments is little short of miraculous. The evolution of the traditional Windows memory API from 1985 to 1992 is summarized in Figure 4.

Of course, the Win32 API brings more to the table than just the traditional Win-

Win32 memory functions shown in Figure 5, specifically designed for the 32-bit flat, paged memory model.

The mapped-file functions, which are the ones we'll concentrate on in this installment, are particularly interesting because they can dramatically simplify applications. The concept behind mapped files is very simple. The data in a mapped file is associated with a range of addresses in the application's memory space. When the application touches a particular address within the mapped range for the first time, it causes a page fault, and the virtual memory manager will go directly to the file, retrieve the ap-

propriate page-size chunk of data, and then place the data in memory at the correct address.

If the application modifies the contents of a page within the mapped range, the hardware will flag the page as "dirty," and the virtual memory manager will then automatically write that page back to the file when the physical page is needed for something else, the file is unmapped, or the program terminates.

The mapped-file functions are elegant on several levels. The work of file buffering is shifted away from the application onto the operating system's virtual memory manager, which can take full advantage of its "magical" knowledge about the underlying paging hardware and the system's free memory resources. The application can freely access any location in the file at any time with a simple memory access, without worrying about allocating, initializing, refilling, or flushing buffers. A mapped file's in-memory pages are demand-allocated out of the system's global pool, so if the overall load on the system is small, the amount of swapping

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that is required for accesses to the mapped file will diminish accordingly. A mapped file can be shared by two or more processes, in effect allowing the processes to communicate through the file "view" and eliminating the redundant allocation of buffers. Best of all, no unnecessary file I/O is ever performed; the only file data that is transferred from disk into memory is the data that the application actually inspects or changes.

USING MAPPED-FILE FUNCTIONS The first step in using the mapped-file functions is to open the file using the familiar Windows functions `OpenFile()`, `CreateFile()`, or `_lopen()`, all of which return a

file handle. The file handle is then supplied to the function `CreateFileMapping()`, along with several other parameters: the maximum number of bytes of the file to map, the access type (read-only or read-write), an optional security attri-

bute, and an optional arbitrary name for the mapping. If `CreateFileMapping()` succeeds, it returns a handle to a file mapping object. And by the way, as you begin to program for NT and to explore the parts of the Win32 API that are not pres-

Memory Management Under Windows

Windows API Memory Function	Parameters	Windows 1.x (real mode)	Windows 3.1 (16-bit protected mode)	Win32/NT (32-bit protected mode)
GlobalAlloc	argument(s)	attributes, number of bytes	attributes, number of bytes	attributes, number of bytes
	results	handle	selector	32-bit offset
GlobalLock	argument(s)	handle	selector	32-bit offset
	results	segment:offset	selector:offset	32-bit offset
GlobalReAlloc	argument(s)	handle, number of bytes, attributes	selector, number of bytes, attributes	32-bit offset, number of bytes, attributes
	results	handle	selector	32-bit offset
GlobalUnlock	argument(s)	handle	selector	32-bit offset
	results	flag	flag	flag
GlobalFree	argument(s)	handle	selector	32-bit offset
	results	handle	selector	32-bit offset

Figure 4: The traditional Windows memory management API as it has evolved from the real-mode Windows of 1985 to the 32-bit protected-mode Win32 of today.

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Win32 Memory Management Functions

Memory allocation	VirtualAlloc(), VirtualFree(), VirtualProtect(), VirtualQuery()
Heap management	HeapCreate(), HeapDestroy(), HeapAlloc(), HeapFree(), HeapSize()
Mapped files	CreateFileMapping(), OpenFileMapping(), MapViewOfFile(), MapViewOfFileEx(), FlushViewOfFile(), UnmapViewOfFile()

Figure 5: These new Win32 functions are specifically designed for the 32-bit flat, paged memory model.

ent in Win16, you're going to have objects coming out of your ears. Objects are everywhere in NT; they are the fundamental unit of resource management. In fact, the NT microkernel's main mission is to create, destroy, and control access to objects. Objects as seen by an application are just handles representing hidden data structures (controlled by the operating system) that encapsulate ownership and state information for processes, memory, files, semaphores, timers, and so on.

In any event, once your program has a file-mapping object in hand, it calls the function `MapViewOfFile()` to associate the mapping object with a range of mem-

ory addresses. `MapViewOfFile()` has a number of parameters, including the mapping object handle, an offset and size that allow a subset of the file to be mapped instead of the entire file, and an access type. Note that access rights are specified at three points during

the mapping procedure: the opening of

the file, the creation of the mapping object, and the mapping of the file view. All of the access rights must be consistent for the file mapping to work.

Assuming that the `MapViewOfFile()` function succeeds, it returns a pointer and the contents of the file are immediately "visible," using the pointer as an address base. (If the application needs to map the file at specific addresses, it can call `MapViewOfFileEx()` rather than allowing the system to assign the addresses.) Suppose we want to create a mapped view of the file `myfile.dat` and zero out the byte at offset 2000h within the file. A skeleton for the required

source code would look like this:

```
HANDLE hFile;
HANDLE hMap;
LPSTR lpMap;
.
.
.
hFile = _lopen("myfile.dat"...);
hMap =
    CreateFileMapping(hFile...);
lpMap = MapViewOfFile(hMap...);
lpMap[0x2000] = 0;
```

When the program is done accessing the file, it destroys the file mapping by calling `UnmapViewOfFile()`, releases the file-mapping object by calling `CloseHandle()`, and finally closes the file itself with `_lclose` or `CloseHandle()`. At any point in between, the program can force the in-memory and on-disk contents of the file to be brought into sync with the `FlushViewOfFile()` function.

Two or more programs can arrange to use a mapped file for interprocess communication in several ways. A mapped-file object handle can be inherited by child processes. A handle can be duplicated and passed to other processes.

HEXVIEW2.C

1 of 2

```
// HexView2 - Hex File Viewer for NT/Win32 Using Mapped File Functions
// Copyright (C) 1992 Ray Duncan
// PC Magazine - Ziff Davis Publications

#define dim(x) (sizeof(x) / sizeof(x[0])) // returns no. of elements
#define EXHIBITSIZE 256 // max length of path-filename
#define BPG 16 // bytes per line

#include "stdlib.h"
#include "windows.h"
#include "string.h"
#include "commDlg.h"
#include "hexview.h"

HANDLE hInst; // module instance handle
HWND hFrame; // handle for frame window
HMENU hChild; // handle for child window

HFONT hFont; // handle for nonprop. font
INT CharX, CharY; // character dimensions
INT LPP; // lines per page
INT BPP; // bytes per page
INT ThumbInc; // bytes per thumb unit
INT WinWidth; // width of frame client area

INT hFile = -1; // handle for current file
char szFilename[EXHIBITSIZE+1]; // name of current file
LONG FileLen; // length of current file
LONG FileIndex; // index from thumb tracking

LONG ViewPtr; // addr, first line current page
LONG TopAddr; // address, top of last page
LONG TopLine; // line num, top of last page

HANDLE hMap; // handle, file mapping object
LPSTR lpMap; // base address, mapping object

.
.
.
// Remaining static variables and tables at start of program
.
.
// are unchanged from previous version of HEXVIEW. WinMain()
.
// and InitApp() routines are unchanged.
```

```
//
// InitInstance --- instance initialization code for this application.
// Gets information about system nonproportional font. Creates frame
// window, gets initialization information (if any) from registration
// database. Positions and sizes window, opens and positions previous
// file if initialization info found.
//
BOOL InitInstance(HANDLE hInstance, INT nCmdShow)
{
    HDC hdc; // handle for device context
    TEXTMETRIC tm; // font information
    RECT rect; // window position & size
    char buff[80]; // scratch buffer

    hFrame = CreateWindow(
        szFrameClass, // create frame window
        szAppName, // window class name
        WS_OVERLAPPEDWINDOW | WS_VSCROLL, // text for title bar
        CW_USEDEFAULT, CW_USEDEFAULT, // window style
        CW_USEDEFAULT, CW_USEDEFAULT, // default position
        CW_USEDEFAULT, CW_USEDEFAULT, // default size
        NULL, // no parent window
        NULL, // use class default menu
        hInstance, // window owner
        NULL); // unused pointer

    if(!hFrame) return(FALSE); // error, can't create window

    hdc = GetDC(hFrame); // get device context
    hFont = GetStockObject(SYSTEM_FIXED_FONT); // realize nonproportional
    SelectObject(hdc, hFont); // realize nonproportional
    GetTextMetrics(hdc, tm); // font, get character size,
    CharX = tm.tmCharWidth; // and calculate window width
    CharY = tm.tmHeight + tm.tmExternalLeading; // and calculate window height
    WinWidth = (CharX * 75) + GetSystemMetrics(SM_CVSCROLL); // release device context
    ReleaseDC(hFrame, hdc);

    GetWindowRect(hFrame, &rect); // get window position, size

    // read saved position/size/profile for our frame window, if any
    rect.left = GetPrivateProfileInt("Frame", "x", rect.left, szIni);
    rect.top = GetPrivateProfileInt("Frame", "y", rect.top, szIni);
```

Figure 6: Extracts from the source code for the mapped-file version of HEXVIEW. The executable program and complete source code files are available for downloading from PC MagNet.

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HEXVIEW2.C

2 of 2

```

rect.right = GetPrivateProfileInt("Frame", "xlr", rect.right, szIni);
rect.bottom = GetPrivateProfileInt("Frame", "ybr", rect.bottom, szIni);

MoveWindow(hFrame, rect.left, rect.top, // force window position, size
WINWidth, rect.bottom-rect.top, TRUE);

// get saved filename and file offset for display, if any
GetPrivateProfileString("File", "filename", "", szFileName,
EXENAME_SIZE, szIni);
GetPrivateProfileString("File", "fileptr", "", buff, sizeof(buff), szIni);

if(szFileName[0]) // if filename and file offset
{ // was saved from previous
    OpenDataFile(); // execution, open the file
    SetFilePosition(atol(buff),
ShowWindow(hFrame, nCmdShow); // make frame window visible
UpdateWindow(hFrame); // force WM_PAINT message
return(TRUE); // return success flag
}

//
// Routines Termination(), FrameWndProc(), ChildWndProc(),
// DoCommand(), DoDestroy(), DoClose(), DoVScroll(), DoPaint(),
// DoChildPaint(), DoSize(), DoMenuExit(), DoMenuAbout(),
// AboutDlgProc(), Repaint(), SetFilePosition(), ConfigDisplay(),
// TrackTrack(), and UpdateFrameProfile() are unchanged from
// previous version of HEXVIEW. Routines ReadDataFile() and
// GetByte() are superfluous and are no longer present.
//
//
// DoMenuOpen -- process File-Open command from menu bar. All
// the hard work is done by the OpenFile common dialog.
//
LONG DoMenuOpen(HWND hwnd, UINT wMsg, WPARAM wParam, LPARAM lParam)
{
    OPENFILENAME ofn; // used by common dialog
    szFileName[0] = '\0'; // init filename buffer

    ofn.lStructSize = sizeof(OPENFILENAME); // length of structure
    ofn.hwndOwner = hwnd; // handle for owner window
    ofn.lpstrFilter = szFilter[0]; // address of filter list
    ofn.lpstrCustomFilter = NULL; // custom filter buffer address
    ofn.nFilterIndex = 1; // pick default filter
    ofn.lpstrFile = szFileName; // buffer for path-filename
    ofn.nMaxFile = EXENAME_SIZE; // length of buffer
    ofn.lpstrFileTitle = NULL; // buffer for filename only
    ofn.lpstrInitialDir = NULL; // initial directory for dialog
    ofn.Flags = OFN_PATHMUSTEXIST | OFN_FILEMUSTEXIST; // title for dialog box
    ofn.lpstrDefExt = NULL; // default extension

    if(GetOpenFileName(&ofn)) // display open dialog
    {
        OpenDataFile(); // open file for viewing
        Repaint(); // force display of data
    }

    return(FALSE);
}

//
// SetWindowCaption -- concatenate the specified filename with the
// application name, then update the frame window's title bar.
// If called with NULL pointer, removes any previous filename from
// the title bar, leaving only the application name.
//
VOID SetWindowCaption(char * szName)
{
    char szTemp[EXENAME_SIZE+1];

    if(szName == NULL) // if null pointer, just
        SetWindowText(hFrame, szAppName); // display application name
    else
    {
        strcpy(szTemp, szAppName); // get application name
        strcat(szTemp, " - "); // add separator
        strcat(szTemp, szName); // add filename
        SetWindowText(hFrame, szTemp); // put result into title bar
    }
}

//
// DisplayLine -- format and display a single line of hex/ASCII dump
// using the device context and relative window line number supplied
// by the caller. The file data offset is calculated from the
// relative window line and the offset corresponding to the line
// currently at the top of the window.
//
VOID DisplayLine(HDC hdc, INT line)
{
    INT i;
    char buff[256], c, *p;
    LONG sz;

    if((ViewPtr + (LONG) line * RPL) < FileSize)
    {
        // format file offset as 8-digit hex number
        p = buff + sprintf(buff, "%08X ", ViewPtr + (LONG) line * RPL);
        // format this 16-bytes as hex data
        for(i = 0; i < RPL; i++)
        {
            x = ViewPtr + (LONG)(line * RPL) + i;
            if(x < FileSize)
                p += sprintf(p, "%02X ", lpMap[x] & 0xff);
            else
                p += sprintf(p, " ");
        }

        // format same 16-bytes as ASCII, using "." for control characters
        for(i = 0; i < RPL; i++)
        {
            x = ViewPtr + (LONG)(line * RPL) + i;
            if(x < FileSize)
            {
                c = lpMap[x];
                if(c < 0x20)
                    c = '.';
                else c = ' ';
                *p++ = c;
            }

            // append a null byte, then print the formatted data
            *p = '\0';
            TextOut(hdc, 0, line * CharY, buff, strlen(buff));
        }
    }
}

//
// OpenDataFile -- open specified file for viewing, save handle. The
// filename was previously placed in szFileName by OpenFile common dialog.
//
VOID OpenDataFile(VOID)
{
    char temp[256]; // scratch formatting buffer

    if(hFile == -1) // if previous file,
    { // release mapping object
        UnmapViewOfFile(lpMap); // and view, then close
        CloseHandle(hMap); // the file
        _lclose(hFile);
    }

    // remove any previous filename from title bar
    SetWindowCaption(NULL);

    hFile = _lopen(szFileName, OF_READ); // try and open the new file
    if(hFile == -1) // error, no such file
    {
        sprintf(temp, "Can't open file: %s", szFileName);
        MessageBox(hFrame, temp, szAppName, MB_ICONSTOP | MB_OK);
        return;
    }

    FileSize = _lseek(hFile, 0, 2); // get size of file

    if(FileSize == 0) // error, nothing to display
    {
        MessageBox(hFrame, "File is empty!", szAppName,
        MB_ICONSTOP | MB_OK);
        _lclose(hFile);
        hFile = -1;
        return;
    }

    // create file mapping object with no maximum size
    hMap = CreateFileMapping(hFile,
    (SECURITY_ATTRIBUTES) NULL, PAGE_READONLY, 0, 0, (LPSTR) NULL);

    if(hMap == 0) // error, no object available
    {
        MessageBox(hFrame, "Can't create file mapping object!",
        szAppName, MB_ICONSTOP | MB_OK);
        _lclose(hFile);
        hFile = -1;
        return;
    }

    // mapping object created, now map view of file onto object
    lpMap = (LPSTR) MapViewOfFile(hMap, FILE_MAP_READ, 0, 0, 0);

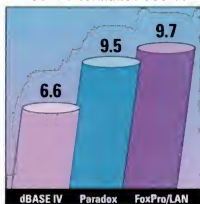
    if(lpMap == 0) // error, no view created
    {
        MessageBox(hFrame, "Can't map view of file!",
        szAppName, MB_ICONSTOP | MB_OK);
        CloseHandle(hMap);
        _lclose(hFile);
        hFile = -1;
        return;
    }

    ViewPtr = 0; // reset window address pointer
    ConfigDisplay(); // set up scroll bar
    SetWindowCaption(szFileName); // put filename in title bar
}

```


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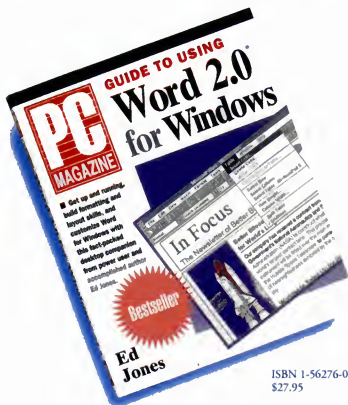
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If a name was assigned to the mapping object during the call to `CreateFileMapping()` and the security attributes allow it, other processes can open the mapping object by name with the function `OpenFileMapping()`. As a special case, there is also a way to use the mapped-file functions for interprocess communication without an associated file, roughly equivalent to the named shared-memory segments of OS/2.

In order to provide a practical example of programming the mapped-file API, I've modified last issue's `HEXVIEW` utility to produce a new version that eliminates explicit file buffering in favor of file mapping. We don't have space to print the complete listing here, but extracts of the source code relevant to the use of mapped files can be seen in Figure 6, and the complete source code and executable program can be downloaded from PC MagNet, archived as `HEXVI2.ZIP`. Ironically, the most important parts of the program conversion are the parts you won't find either here or on PC MagNet: The code to allocate and release a file I/O buffer and the routines `ReadDataFile()` and `GetByte()` all go away, as they are not needed.

FURTHER READING These references can help you learn more about managing memory in a 32-bit environment:

- *Win32 Programmer's Reference: Overviews*. Chapter 2, "Memory Management," and Chapter 7, "File Mapping." Microsoft Press, Redmond, Washington, 1992.
- "An Introduction to Windows NT Memory Management Fundamentals," by Paul Yao. *Microsoft Systems Journal*, July/August 1992, volume 7, number 4, page 41.
- *Microsoft's 80386/80486 Programming Guide*, 2nd Edition, by Ross Nelson. Microsoft Press, Redmond, Washington, 1991. ISBN: 1-55615-343-0.
- *Programming the 80386*, by John Crawford and Patrick Gelsinger. Sybex Inc., Alameda, California, 1987. ISBN: 0-89588-381-3.

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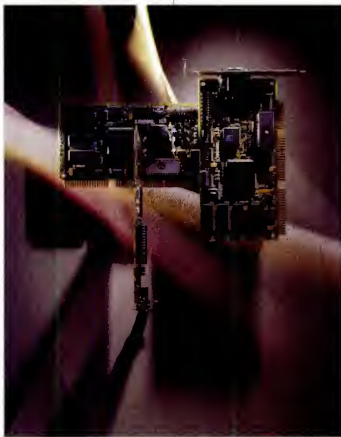
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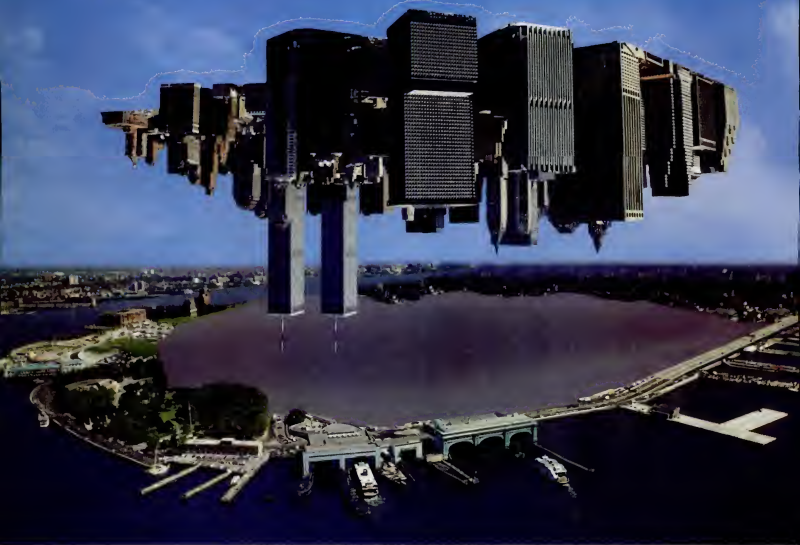
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DATABASES

A Black-Box Copy Function: This Clipper 5.0 function copies records between differently structured databases.

BY SAL RICCIARDI

A Black-Box Copy Function

In the January 28, 1992, Databases column, Mike Schinkel showed a way to copy records from one database to another. His example used the `FIELDGET()` and `FIELDPUT()` functions to copy individual fields. `FIELDGET(1)` loaded the first field, `FIELDGET(2)` the second, and so on. While this example works well, it requires that the source and destination databases have the same structure, as you noted. If the destination database has an extra field or two, it could cause the field positions to line up incorrectly, in which case the function won't work. To address this situation, I've created the `DupRec()` function, shown in Figure 1. It is a generic function that works even if the fields are not lined up in the same places. It uses still more new functions in Clipper 5.01.

In `DupRec()`, the `DBSTRUCT()` function returns a two-dimensional array, `aArray`, that contains the structure of the current database. The array has one row for each field in the database and each row contains elements for the field name, type, length and number of decimal places. For our purposes, we really only need the field name.

The `aArray` array returned by the `DBSTRUCT()` function is manipulated throughout the rest of the `DupRec()` function. Figure 2 shows an example of the contents of `aArray` at several steps in `DupRec()`'s processing. `DupRec()` makes several calls to the `AEVAL()` function, which is an iterator function for arrays—so-called because it steps through (or iterates through) every element in an array.

To use it, you pass it an array name and a code block, and it applies the code block to each element of the array in sequence. A code block is a data type, a section of compiled Clipper code that is treated like data until you execute it.

For instance, the code block:

```
{X}*2}
```

will multiply its parameter by 2. In this example the code block is everything between the `{` and `}`, while the `X` between the piping symbols represents a parameter passed to the code block.

When the block is executed, `X*2` is evaluated and returned. You can think of a code block sort of as a function. In fact the above example could be rewritten as a function:

```
FUNCTION Times2 (X)
RETURN X * 2
```

The advantage with a code block, however, is that it can be assigned to a memory variable and passed as a parameter to a function.

In `DupRec()`, the line:

```
AEVAL(aArray,
{ |A| A[3] :=
FIELDBLOCK(A[1]) })
```

steps through the array named `aArray`, processing the code block for each row in the array. Each row is passed as a one-dimensional array to the code block, which receives it as `A`. Remember that each row contains information about a particular field in the database. The code block then calls the `FIELDBLOCK()` function with the first element, which is a field name. `FIELDBLOCK()` itself returns a code block, which is then stored in the third element of `A`, replacing what was previously the field length. In this manner the third column in `aArray` is filled with code blocks returned by `FIELDBLOCK()`. (See the second example shown in Figure 2.)

The `FIELDBLOCK()` function cre-

The DupRec() Function

Complete Listing

```
*****
* Function DupRec( nToArea )          Clipper 5.01
* Copies current record in current work area to current
* record in destination work area.
*****

FUNCTION DupRec( nToArea )
  Local aArray, nFromArea
  nFromArea := SELECT()
  aArray := DBSTRUCT()

  ** Get current work area
  ** Make a new array with names
  ** of all the fields

  AEVAL(aArray, { |A| A[3] := FIELDBLOCK(A[1]) })
  * This creates a set-get code block in aArray[x,3] which had
  * contained the field length
```

```
AEVAL(aArray, { |A| A[2] := EVAL(A[3]) })
* This executes the code block for each row in aArray and loads
* the record into the array (in the second position)

SELECT ( nToArea )          ** Select Destination Work Area

AEVAL(aArray, { |A| EVAL(A[3], A[2]) })
* This executes the code block for each row in aArray and saves
* the record from the array to the database

SELECT ( nFromArea )        ** Return to from work area

RETURN                      ** Return to caller
```



Figure 1: The `DupRec` function shown here copies a record from one database to another without depending on the order of the fields. `Rec2Array` and `Array2Rec` (originally from Databases, January 28, 1992) are rewritten here to support field order independence.

The Contents of aArray

```

The aArray array after:
aArray := DBSTRUCT()

      [1]      [2]      [3]      [4]
aArray[1] "CUSTNO"  "C"      6      0
aArray[2] "LAST"    "C"      50     0
aArray[3] "FIRST"   "C"      50     0
etc.

The aArray array after:
AEVAL(aArray, {A[3] := FIELDBLOCK( A[1] ) })

      [1]      [2]      [3]      [4]
aArray[1] "CUSTNO"  "C"      "1 ... 1" 0

```

```

aArray[2] "LAST"    "C"      "1 ... 1" 0
aArray[3] "FIRST"   "C"      "1 ... 1" 0
etc.

The aArray array after:
AEVAL(aArray, {A[2] := EVAL( A[3] ) })

      [1]      [2]      [3]      [4]
aArray[1] "CUSTNO"  "500218" "1 ... 1" 0
aArray[2] "LAST"    "Smith"   "1 ... 1" 0
aArray[3] "FIRST"   "Tom"     "1 ... 1" 0
etc.

```

Figure 2: DupRec() first populates the aArray array with field values and a custom set-get code block for each field. Then, after changing to the destination work area, it walks through the array, using the set-get code blocks in column 3 to write out the field values in column 2.

TDUPR.PRG

Complete Listing

```

*****
* TDUPR.PRG                               Clipper 5.01
* Test program to exercise the DupRec function. Copies
* the database specified on the command line to a new database
* whose structure is sorted alphabetically by field name.
* Use like this: TDUPR fromdbf todbf
*****
PARAMETERS cFrom, cTo
SET PROCEDURE TO TDUPR
DO CASE
CASE ( cFrom=NIL .OR. cTo=NIL )
? "Usage: TDUPR fromdbf todbf"
RETURN
CASE AT(".",cTo) > 0          && Don't pass a file extension
? "Don't work with file extension."
RETURN
CASE cFrom = cTo
? "Can't copy a file onto itself"
RETURN
*****
ENDCASE
USE (cFrom) NEW
nRecs = RECNOCTO()
COPY STRUCTURE EXTENDED TO (cTo)
USE (cTo) NEW
CTMP = cTo + ".$$$"
SORT TO (CTMP) ON Field_name
ERASE (cTo)
CREATE (cTo) FROM (CTMP)
ERASE (CTMP)
FOR x = 1 TO nRecs
APPEND BLANK
ENDFOR
GO TOP
SELECT 1
AEVAL ( { || DupRec ( 2 ), (cTo)->DBSKIP() } ) && Do the copy
CLOSE DATABASES
RETURN

```



Figure 3: This example program illustrates the DupRec() function, which copies a database record from one database to another without depending on the order of the fields. It creates a copy of a source database with the field names sorted alphabetically.

ates and returns a code block that gets or sets the value for a particular field. You pass FIELDBLOCK() the name of a field in the current work area and it returns a custom set-get code block for that field. (Note in Figure 2 that the set-get code blocks are shown as { || ... } in keeping with the convention used in the Clipper debugger.) For example, the statement

```
gsBlock = FIELDBLOCK( "CUSTNO" )
```

returns a set-get code block named gsBlock for the CUSTNO field. The gsBlock code block is the conceptual equivalent of the following function:

```

FUNCTION gsBlock
PARAMETER setval
IF setval <> NIL
REPLACE CUSTNO WITH setval
ENDIF
RETURN CUSTNO

```

The code block returned by FIELDBLOCK() can be executed using the

EVAL() function. To do this you pass EVAL() the name of the code block and any parameters to be passed to the code block. A set-get code block accepts a single optional parameter. If no parameter is present, the code block returns ("gets") the current contents of the field. If a parameter is passed, the field is replaced ("set") with the parameter.

When AEVAL is finished, each row in the aArray array contains a field name, type, set-get code block for that field, and the number of decimal places.

In DupRec(), the next line:

```

AEVAL(aArray,
{A[3]A[2] :=
EVAL(A[3])})

```

steps through the array, executing the set-get block in get mode to retrieve the value of each field and store it in the second column of the array. When this is finished, the rows in the aArray array contain field name, field contents, set-get code block for that field, and number of decimal places. (See the third and final

example shown in Figure 2.)

Now that we have read the record into memory and stored its contents in the second column of the aArray array, we can change to the destination work area and write the record to the destination database. The line

```

AEVAL(aArray,
{A[3]
EVAL(A[3], A[2])})

```

steps through the aArray array one last time. Now that the set-get code blocks are in column 3 and the values are in column 2, this AEVAL() steps through the array and executes the set-get code blocks in column 3 one more time, this time in set mode. For each row, it passes the value stored in column 2 to the set-get code block. This causes the code block to replace the value in the destination database with the one that is stored in column 2.

The main advantage to using this method is that the fields are replaced by name instead of by number, so the order

of the fields in the database structure doesn't really matter.

Ronald Hansen
Staten Island, New York

► **PC MAGAZINE** If your source and destination database structures are exactly the same, Mr. Schinkel's original routine will run faster. If not, Mr. Hansen's DupRec() will work even if the source and destina-

performs a SKIP in the current work area after each iteration. In order to also move the record pointer in the destination work area, the call to DBSKIP() was required. The (cTo)-> uses Clipper's alias operator. This causes Clipper to change to the destination work area automatically before issuing the DBSKIP() and to change back afterwards.

DupRec() works by filling the aArray array with the current record's field values and a custom set-get code block for each field. Then, after changing to the destination work area, it walks through the array, using the set-get code blocks to write out the field values to the destination database.

To understand the DupRec() code, let's take a closer look at Figure 2. The real workhorse in DupRec() is Clipper's AEVAL() function, one of several new functions introduced in Clipper 5.0. In DupRec(), the AEVAL() function is called three times. The first call to AEVAL() fills the third column of the array with set-get code blocks for each field. The second call executes each of the set-get code blocks in get mode to load the source database values into column 2. The third call executes each of the set-get code blocks in set mode to write the values to the destination database.

Figure 2 illustrates the aArray array after the call to DBSTRUCT() and after the first two calls to AEVAL(). The elements that show { || ... } represent Clipper code blocks.

Source code for this column can be found in DUPREC.ZIP on PC MagNet. Look in the Utilities/Tips Forum, Databases section. □

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The real workhorse in

DupRec() is AEVAL(), one of several new functions introduced in Clipper 5.0.

tion fields are not lined up in the same positions.

In order to try DupRec(), I wrote the TDUPR program shown in Figure 3. TDUPR takes a source database and creates a copy of it with its field structure sorted in alphabetical order, just to show that DupRec() doesn't care about the order of the fields.

You'll notice the following line in the code listing:

```
DBEVAL( { || DupRec( 2 ) ,  
(cTo)->(DBSKIP( 1 ) ) }  
&& Do the copy
```

The DBEVAL() function is like the AEVAL() function except that it works on a database instead of an array. It evaluates a code block for each record in the current work area that falls within the specified scope or condition. (The scope defaults to ALL.) On each iteration, the specified code block is evaluated.

In the line above, I use DBEVAL() to call the DupRec() function for every record in the current work area, passing to DupRec() the destination work area number. DupRec() dutifully copies each record from the current work area to the destination work area, unimpeded by the fact that the field structures for the two databases are not ordered the same way.

You'll notice a second expression, a call to DBSKIP(), in the code block (you can have as many expressions as you want in a code block, separated by commas). The DBEVAL() function automatically

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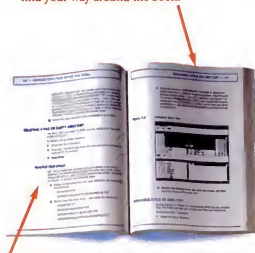
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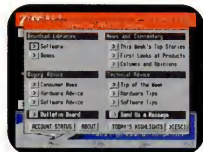
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PCM11110

Building Up a PChar: The easily extensible TString object is a "smart" PChar.

EDITED BY SHARON TERDEMAN

Building Up a PChar

I seem to need to build PChar type strings in just about every program I write, so I now use a string object, TString, which I have written as a Unit (see Figure 1). It uses object methods to add to the string and a function that returns the address

of the PChar it builds, which can be passed to other procedures and functions. I know this is a completely different approach to wvsprintf, but it's easy enough to add another method for, say, double reals.

*Stephen John Baugh
Bracknell, Berkshire, United Kingdom*

► **PC MAGAZINE** Like Mr. Baugh, I frequently need to build up a PChar from many disparate parts. Often the power of the wvsprintf function is insufficient, and there's no way to extend wvsprintf. The TString object is an excellent object-oriented alternative.

Just to show how easy it is to extend

OSTRING.PAS

Complete Listing

```
UNIT Ostring;
(** INTERFACE **)
USES Wobjects, Strings;
TYPE
  HeadStr = ARRAY[0..2] OF Char;
(** Object Class : TString *)
( Declare TString )
TString = ^TString;
TString = OBJECT(TObject)
  PChar : PChar;
  MaxSize : Word;
  CONSTRUCTOR Init(MaxSize : Word);
  DESTRUCTOR Done; Virtual;
  PROCEDURE AddPChar(P : PChar); Virtual;
  PROCEDURE AddString(S : String); Virtual;
  PROCEDURE AddString(S : TString); Virtual;
  PROCEDURE AddInteger(I, FieldSize : Integer); Virtual;
  PROCEDURE AddReal(R : Real; FieldSize, Decimals :
    Integer); Virtual;
  PROCEDURE AddHeadByte(B : Byte); Virtual;
  PROCEDURE AddHeadWord(W : Word); Virtual;
  PROCEDURE Clear; Virtual;
  FUNCTION Len : Word; Virtual;
  PROCEDURE NextLine; Virtual;
  FUNCTION GetPChar : PChar; Virtual;
(** PRIVATE **)
  FUNCTION Hex(b : Byte; VAR H : HeadStr) : PChar;
END;

(** IMPLEMENTATION **)
FUNCTION TString.Hex(b : Byte; VAR H : HeadStr) : PChar;
CONST
  HexDigit : Array[0..15] OF Char = '0123456789ABCDEF';
BEGIN
  H[0] := HexDigit[b SHR 4];
  H[1] := HexDigit[b AND $F];
  H[2] := #0;
  Hex := H;
END;

CONSTRUCTOR TString.Init(MaxSize : Word);
BEGIN
  GetMem(vPChar, vMaxSize);
  MaxSize := vMaxSize;
  vPChar[0] := #0; (Put a null at the start of the string)
END;

DESTRUCTOR TString.Done;
BEGIN
  FreeMem(vPChar, MaxSize);
END;

PROCEDURE TString.AddPChar(P : PChar);
BEGIN
  StrCat(vPChar, P, MaxSize);
END;

PROCEDURE TString.AddString(S : String);
VAR P : PChar;
```

```
BEGIN
  GetMem(P, 256);
  StrPCopy(P, S);
  AddPChar(P);
  FreeMem(P, 256);
END;

PROCEDURE TString.AddString(S : TString);
BEGIN
  AddPChar(S.vPChar);
END;

PROCEDURE TString.AddInteger(I, FieldSize : Integer);
VAR S : String;
BEGIN
  Str(I, FieldSize, S);
  AddString(S);
END;

PROCEDURE TString.AddReal(R : Real; FieldSize,
  Decimals : Integer);
VAR S : String;
BEGIN
  Str(R, FieldSize, Decimals, S);
  AddString(S);
END;

PROCEDURE TString.AddHeadByte(B : Byte);
VAR H : HeadStr;
BEGIN
  AddPChar(Hex(B, H));
END;

PROCEDURE TString.AddHeadWord(W : Word);
BEGIN
  AddHeadByte(HI(W));
  AddHeadByte(LO(W));
END;

PROCEDURE TString.Clear;
BEGIN
  vPChar[0] := #0; (Put a null at the start of the string)
END;

FUNCTION TString.Len : Word;
BEGIN
  Len := StrLen(vPChar);
END;

PROCEDURE TString.NextLine;
BEGIN
  AddString(#13#10);
END;

FUNCTION TString.GetPChar : PChar;
BEGIN
  GetPChar := vPChar;
END;
END;
```

Figure 1: The TString object is used to build complicated strings from any number of parts.



ESTRING.PAS

Complete Listing

```
UNIT EString;
(**) INTERFACE (**)
USES WObjects, Strings, OString;
TYPE
  PString = ^TString;
  TString = OBJECT(TOString)
    Excess : Word;
  CONSTRUCTOR Init(WMaxSize : Word);
  PROCEDURE AddChar(P : PChar); Virtual;
  FUNCTION ExpandTo(W : Word) : Boolean;
  FUNCTION GetExcess : Word;
END;

(**) IMPLEMENTATION (**)
CONSTRUCTOR TString.Init(WMaxSize : Word);
BEGIN
  TOString.Init(WMaxSize);
  IF vPChar = NIL THEN Fail;
  Excess := 0;
END;

PROCEDURE TString.AddChar(P : PChar);
BEGIN
  IF Len + StrLen(P) > MaxSize THEN
    Inc(Excess, Len + StrLen(P) - MaxSize)
  ELSE
    TOString.AddChar(P);
  END;
END;
```

```
FUNCTION TString.GetExcess : Word;
BEGIN
  GetExcess := Excess;
END;

FUNCTION TString.ExpandTo(W : Word) : Boolean;
VAR P : PChar;
BEGIN
  ExpandTo := FALSE;
  (- don't SHRINK smaller than current contents! -)
  IF W < Len THEN Exit;
  GetMem(P, W+1);
  (- fail if can't allocate bigger PChar -)
  IF P = NIL THEN Exit;
  (- copy contents to new, bigger PChar -)
  StrCopy(P, vPChar);
  (- get rid of puny old PChar -)
  FreeMem(vPChar, MaxSize+1);
  vPChar := P;
  MaxSize := W;
  Excess := 0;
  ExpandTo := TRUE;
END;
END.
```



Figure 2: In this unit, the **TString** object extends **TOString**, giving **TOString** the ability to expand its capacity.

USTRING.PAS

Complete Listing

```
PROGRAM UString;
USES WinCrt, OString, EString;
VAR
  PO : TString;
  PE : TString;
  OldLen : Word;
BEGIN
  PO.Init(300);
  PO.AddChar('I am a TString. ');
  PO.AddChar('The value of pi is: ');
  PO.AddReal(pi, 1, 5);
  PO.NewLine;
  PO.AddChar('My own address is: ');
  PO.AddHexWord(Seq(PO));
  PO.AddChar(' ');
  PO.AddHexWord(Ord(PO));
  PO.NewLine;
  REPEAT
    OldLen := PO.Len;
    PO.AddChar('Adding too much text. ');
    PO.AddChar('line after line after line!');
    PO.NewLine;
  UNTIL OldLen = PO.Len;
  WriteBuf(PO.GetChar, PO.Len);
```

```
WriteLn;
WriteLn;
PO.Clear;
PO.AddChar('Adding too much text. ');
PO.AddChar('line after line after line!');
PO.NewLine;

PE.Init(300);
PE.AddChar('I am an expandable TString - a TString');
PE.NewLine;
REPEAT
  PE.AddOString(PO);
  UNTIL PE.GetExcess > 0;
  IF PE.ExpandTo(400) THEN
    BEGIN
      PE.AddChar('I ran out of space, so I expanded ');
      PE.AddChar('to make more room!');
      PE.NewLine;
    END;
  WriteBuf(PE.GetChar, PE.Len);
  PO.Done;
  PE.Done;
END.
```



Figure 3: This program exercises both the **TOString** and **TString** objects, defined in Figures 1 and 2.

this **PChar** object, I wrote the **EString** Unit shown in Figure 2, which implements **TString**, an expandable **TOString**. All the methods of **TOString** that add to the **vPChar** field do so via the virtual **AddPChar** method. I overrode that method with a version that checks whether there's room before attempting to add anything and if not, keeps track of how many more bytes are needed.

The calling program can use the **GetExcess** method after one or more calls to methods that add to the **PChar**. If **GetExcess** returns a nonzero amount, there isn't enough room. A call to the **ExpandTo** method will expand the **TString**'s capacity. **ExpandTo** simply

creates another **PChar** of whatever size is passed to it, copies the contents of the **vPChar** field into the new **PChar**, and deletes **vPChar**. It's a Boolean function, returning **FALSE** only if you attempt to set the **TString**'s capacity to a size smaller than its current contents, or if there isn't enough memory for the expansion.

Program **UString** in Figure 3 exercises the abilities of both **TOString** and **TString**. Note that when it attempts to add too many lines to the **TOString**, the contents simply get cut off at the last available byte. The **TString**, by contrast, only adds complete lines, and it's easy to determine when the **TString**'s capacity has been reached. The example program

uses the **WinCrt** Unit for display, but the most likely use for a **TOString** is in building the text of message boxes. (You can download all three files from PC MagNet as **TOSTRI.ZIP**.)—Neil J. Rubenking □

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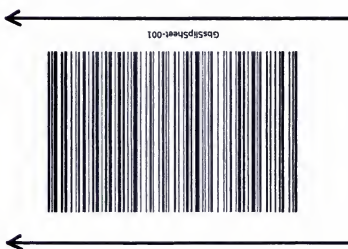
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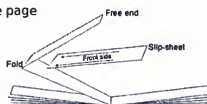
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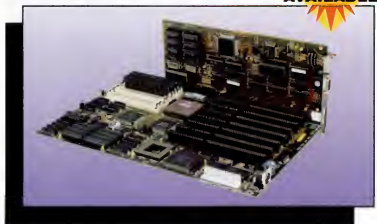
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Source: COMPUTER SHOPPER, July 1992, Local Bus Video Review, page 184.



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BY JOE SALEMI

Multilingual Word Processors

I'm looking for a Russian word processor, preferably for Windows, but at least as powerful as Word or WordPerfect. It has to work entirely in Russian, including help menus. Do you know of such a product?

*Scott W. Leopold
Seattle, Washington*

► **PC MAGAZINE** It must be a sign of the times: I've received a number of similar inquiries recently. Luckily, there are several Russian and Russian/English word processors available.

Cyrillic Support for Windows (Exceller Software Corp., Cornell Business/Technology Park, 223 Langmuir Laboratory, Ithaca, NY 14850; 800-426-0444, 607-257-5634) is a Windows 3.1-based word processor that works entirely in Russian and supports a number of dialects, including Ukrainian and Serbian. The base package sells for \$129 and includes multiple definable keyboards for the different dialects, as well as Cyrillic fonts for HP LaserJet II and III printers. Exceller also has a package of Cyrillic TrueType fonts available for an additional \$129. You can order both packages (either directly or through the larger software chains) for \$199.

DynaComp (DynaComp Office Building, 178 Phillips Rd., Webster, NY 14580; 800-828-6772, 716-265-4040) sells the Multilingual Word Processor that supports a number of languages, including Russian, Hebrew, Arabic and modern Greek. Though DOS-based, it displays the proper alphabet on the screen and supports right-to-left as well as left-to-right writing. The Multilingual Word Processor is available direct and costs \$99.95

for the 5.25-inch version or \$104.95 for the 3.5-inch version. DynaComp also sells a pop-up Russian/English dictionary for the same prices; it uses about 60K of RAM.

Interword (Interword Corp., 2108-C Gallows Rd., Vienna, VA 22182; 703-442-0070; \$299) is another multilingual word processor that lets you mix and match different parts of the program. For example, you can have the help menus in English and the text in Russian, or vice versa. Interword20 is DOS-based and supports 20 different languages. For an additional \$20, you can get a clear keyboard overlay that shows the Cyrillic characters along with the English ones.

You can edit multiple languages in the same document at the same time with Universal Word, a DOS-based package from WYSIWYG (5959 W. Century Blvd., Penthouse Floor, Suite 1422, Los Angeles, CA 90045; 800-776-7674, 310-215-9645; \$529). In addition to Russian, it supports several European languages as well as Chinese, Japanese, Hindi, and Korean.

For a different approach, you can add foreign character sets to your Windows applications with Worldfont for Windows (Data-Cal Corp., 531 E. Elliot Rd., Suite 145, Chandler, AZ 85225; 800-223-0123, 602-545-1234; \$249.95). This is a set of Adobe Type 1 and TrueType fonts for

Windows 3.x that includes one typeface for each of up to 30 languages, including Cyrillic and Hebrew. Additional sets of up to five typefaces for a particular language sell for \$99.95.

Screen Magnifiers

One of our users has diabetes-related vision problems. Is there any special software or hardware that will ease computing for the visually impaired?

*David M. Sandhaus, Esq.
Spokane, Washington*

► **PC MAGAZINE** Artic Technologies International (55 Park St., Troy, MI 48063; 313-588-7370) sells the Artic FOCUS (\$495) and Artic Business FOCUS (\$695) software utilities that create very large fonts on-screen and let the user scroll around the screen to see the full lines of text. FOCUS supports CGA, EGA, and VGA systems (including laptops and notebooks) and magnifies the screen characters up to 8 times their normal size. It can use expanded memory as a font buffer when multiple fonts are loaded and also lets the user split the screen horizontally or vertically. Business FOCUS increases the magnification capabilities to 10 times normal size, adds support for Hercules video adapters and for DOS graphics applications (up to 16-times magnification), and also magnifies Windows 3.x.

Artic sells a number of additional support packages for the visually impaired. FOCUS Pedals (\$225) lets the user control scrolling and magnification with his or her feet (an ISA interface card is included), and Gizmo Pad (\$325) is an external keypad that assists in scrolling around the screen and positioning the

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cursor. FOCUS Print is a software add-on currently under development that uses the FOCUS fonts to create large-size printouts of ASCII files on Epson FX or HP LaserJet printers.

Visually impaired users may also be interested in products sold by TeleSensory (455 N. Bernardo Ave., Mountain View, CA 94043; 800-227-8418, 415-960-0920). The Vista VGA System 1 (\$2,495) and the Vista/2 System (\$2,595), are hardware/software combinations that magnify the screen up to 16 times for text and graphics (including Windows 3.x). These products let the user zoom in and out on portions of the screen and are controllable with a mouse. The Vista VGA System 1 works on any ISA bus system; the Vista/2 System provides the same capabilities for PS/2 or other MCA systems.

ZoomText (\$495) is TeleSensory's software-only screen magnifier. It works with text only and doesn't provide mouse support or full zooming capabilities. An enhanced version of this product, Zoom-Text Plus (\$595), adds support for enlarging graphics and Windows 3.x.

TeleSensory also has a complete line of Closed Circuit Televisions (CCTVs) that can be used to enlarge printed text onto a screen for easier reading. The CCTV line ranges from the low-end Voyager CCD (\$2,395), which has a 12-inch black and white, amber, or green monitor and magnifies text up to 45 times, to the high-end Chroma CCD, which includes a 14-inch (\$3,295) or a 20-inch (\$3,495) color monitor and magnifies text 60 times. There are a number of specialized options available for all the CCTV systems; contact TeleSensory for details.

Fonts for a DeskJet

Please clue me in on fonts. I know that some come loaded on the printer, others are available on a cartridge that fits onto the printer, and still others are a software add-on. What are the advantages and disadvantages of each? I'm starting to build my system from scratch and I'd like the most versatility with the least possible overlap. My initial printer selection has been narrowed down to an ink jet printer, either the HP DeskJet 500C or a Canon BJC 800/820.

Harvey K. Pollack
Forest Hills, NY

► **PC MAGAZINE** As you've discovered, there are many ways to get the typefaces you want out of a printer. The internal fonts have one major advantage: They're always present, and any printer drivers that support your printer will support those fonts. Unfortunately, the number of internal fonts is usually limited, so if you want more, you have to purchase add-on fonts, either as a hardware cartridge that plugs into a slot on the printer, or as software fonts that are downloaded to the printer when needed. In both cases, you also have to be sure that the new fonts are supported by your applications, directly or with additional drivers provided by the font vendor.

Hardware font cartridges have the advantage of speed, as the fonts become part of the printer's internal workings. However, the number of fonts and different point sizes you get in the cartridge are also limited. There are a number of add-on cartridges for the HP DeskJet 500C series of printers (more than there are for the Canon at this time), so that may be the better choice for your needs.

Among the many font cartridges available are the Elefont Cartridges Plus (Elesys Inc., 528 Weddell Dr., Sunnyvale, CA 94089; 800-637-0500, 408-747-0233; \$149), which includes four typeface families (collections of different point sizes of the same font) with sizes ranging from 5 points to 30 points, as well as a number of math and scientific symbols. Hewlett-Packard Co. (3000 Hanover St., Palo Alto, CA 94304; 800-752-0900, 415-857-1501) sells the WordPerfect Font Cartridge (\$140), which includes Times and Universal fonts in 6 to 24 points and works with WordPerfect 4.2 and later.

IQ Engineering (685 N. Pastoria Ave., Sunnyvale, CA 94086; 800-765-3668, 408-733-1161) is a well-known maker of font cartridges for the HP LaserJet and also provides a line of cartridges for the DeskJet, including the Super Cartridge DJ/500 Standard (\$99), which has 64 fonts. The Super Cartridge DJ/500 Professional (\$149) contains all the fonts of the standard model, plus a number of large-type headline fonts.

Finally, there's the 25-in-One! for DeskJet from Pacific Data Products (9125 Rehco Rd., San Diego, CA 92121; 619-552-0880; \$149), another well-known maker of cartridges for HP LaserJets.

The 25-in-One! includes, as its name implies, 25 different fonts.

Software fonts are the most versatile because they're generally not limited in point size; you can generate the size of the font you need on the fly. The proper font is then downloaded to the printer along with the print job, or it can be stored in the printer's on-board memory for later use (at least until the printer is turned off). You'll have to increase the amount of RAM inside the DeskJet printer to use the soft fonts, though, as they take up RAM that would otherwise be used for the printing of text or graphics. Elesys makes two add-on memory boards for the DeskJet: the Elememory 128K (\$89) and the Elememory 256K (\$159), which respectively add 128K or 256K of on-board RAM to the printer for holding downloaded soft fonts.

Soft fonts are widely available from vendors such as Adobe, ZSoft, and Bitstream, and they support a number of applications. The best way to use soft fonts, however, is in one of the graphical operating environments, such as Microsoft's Windows 3.1 or IBM's OS/2 2.0. The soft fonts become part of the environment and can be used by any of the environment's native applications. OS/2 2.0 includes the Adobe Type Manager that is used by OS/2 Presentation Manager programs as well as Windows 3.0 programs that run inside OS/2. Windows 3.1 includes internal support for TrueType fonts and can also use several third-party fonts. As with font cartridges, if you're going to use soft fonts in DOS applications, you need to make sure that either the application supports the soft fonts or that the soft fonts package includes the appropriate drivers for the applications you use.

For more information about fonts, see the review "Scalable Fonts for the PC" by Edward Mendelson that appeared in the September 24, 1991, issue of *PC Magazine*. □

ASK THE ADVISOR

Send your questions to Advisor, *PC Magazine*, One Park Ave., New York, NY 10016. Or you can send it via e-mail to our MCI mailbox (*PC Magazine*) or, on CompuServe, to 72241.104.

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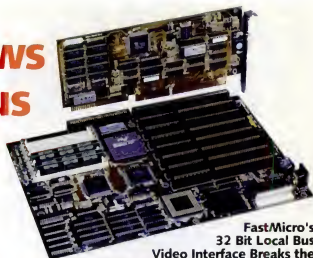
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failures) rating of more than 150,000 operating hours. If you ran your FastData system 24 hours a day - that's more than 17 years!

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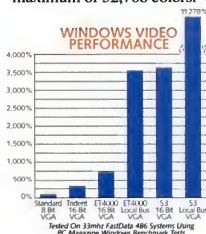
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Cache Upgradeable	X		?
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GE On-Site Service	X		
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7 Drive Bays	X		
Dual Cooling Fans	X		
GE On-Site Service	X		
Money Back Guarantee	X	X	X
7th Year in Business	X	?	?

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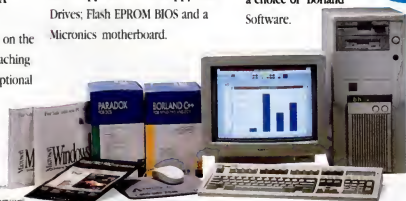
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TUTOR

Upper-Memory Conflicts: What to do when EMM386 fails to recognize adapter ROM or RAM.

BY JEFF PROSISE

Upper-Memory Conflicts

I have a persistent problem that neither the technicians at Northgate nor the computer support personnel at the university where I teach have been able to solve. When I load a memory-resident program or device driver high using DOS 5.0, my PC locks up, despite the fact that typing MEM /C shows more than 80K of upper memory free. Can you tell me why this is happening and what I can do about it? I have enclosed a copy of my CONFIG.SYS file.

C. C. Chu
Ithaca, New York

► **PC MAGAZINE** The most common cause for unexplained lockups that occur when a program or device driver is loaded high is that EMM386.EXE has mapped an upper memory block (UMB) into a region of memory containing adapter ROM or RAM. When this happens, conflicts occur that ultimately produce a system crash. In the typical scenario, a UMB is created over a region of memory that contains ROM. When a program tries to access code or data stored in that ROM, the memory access is redirected to the UMB. The program doesn't realize that the information it just obtained didn't come from the ROM, so it attempts to execute the code or to act upon the data. Because the code or data is bogus, the CPU locks up.

How does this situation occur? When EMM386.EXE is loaded with a RAM or NOEMS switch, it scans the C000h and D000h segments of upper memory for unused address space it can convert to UMB RAM or use for an EMS page frame. This conversion is accomplished by running DOS in Virtual 86 mode and using the paging capability of the 80386 chip to redirect memory accesses from

addresses in upper memory (the region from 640K to 1MB) to addresses in extended memory (memory above 1MB). To the user, it appears that empty areas between 640K and 1MB have been back-filled with usable RAM.

Figure 1 illustrates what happens when EMM386.EXE is asked to create UMB RAM on a PC whose C000h and D000h segments are free of adapter ROM and RAM. On this PC, EMM386.EXE creates a 128K UMB that occupies the C000h and D000h segments.

*The most reliable way to
resolve upper-memory
conflicts in your system is to
experiment with different
X= switches until you
find one that works.*

If there is unused address space elsewhere in upper memory, it can be converted to UMB RAM by adding an I= (Include) switch to the line in CONFIG.SYS that loads the EMM386.EXE driver. For example, if the E000h segment of memory is unused on your machine (as it is on most PCs), installing EMM386.EXE with an I=E000-EFFF switch, as in

```
DEVICE=C:\DOS\EMM386.EXE NOEMS  
I=E000-EFFF
```

creates an extra 64K of UMB RAM that you can use to load TSRs and device drivers high.

Figure 2 shows what the upper memory area would look like on the same PC

if EMM386 detects a 32K region of adapter ROM or RAM spanning segment addresses C800h to CFFFh. In this configuration, EMM386.EXE creates two UMBs: a 32K UMB located at segment address C000h and a 64K UMB at D000h, judiciously avoiding the 32K reserved for hardware use. This gives you 32K less UMB RAM to use with LOADHIGH and DEVICEHIGH, but it ensures that TSRs or device drivers loaded high will not conflict with the adapter that is using that part of upper memory.

In your case, EMM386.EXE probably failed to recognize a region of adapter ROM or RAM. This is a common problem among DOS 5.0 users, because it's impossible for EMM386.EXE to identify all adapter ROMs and RAMs on all PCs. (Third-party memory managers such as QEMM-386 and 386MAX do a better job of avoiding conflicts than EMM386.EXE, but even they are not perfect.) Your CONFIG.SYS file indicates that you haven't used the I= switch to create additional UMB RAM, so the conflict must lie somewhere in the C000h or D000h segments. If you can identify the area where the conflict occurs, you can solve the problem by excluding the offending region of memory from EMM386.EXE with an X= switch. The key, though, is to find out exactly where the conflict occurs.

RESOLVING UPPER-MEMORY CONFLICTS

There are several ways to pinpoint sources of conflict between EMM386.EXE and the hardware installed in your system. The most reliable method is to experiment with different X= switches until you find one that works. The ideal solution is the one that excludes the smallest amount of memory from EMM386.EXE and at the same time prevents lockups.

Upper Memory with No Adapter ROM or RAM

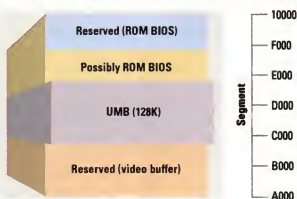


Figure 1: On a PC with no adapter ROM and RAM in the C000h and D000h segments, EMM386.EXE will create 128K of UMB RAM starting at C000h and extending to the top of D000h. Most versions of EMM386.EXE will not use the A000h, B000h, E000h, and F000h segments of upper memory unless instructed to.

The fastest way to locate the adapter ROM is to determine where it *isn't*. Alter your CONFIG.SYS to exclude half of the total address range used by EMM386, then load a TSR or device driver high and reboot. If your PC still locks up, modify CONFIG.SYS once again to exclude the other half. The object is to determine in which half the conflict lies. Repeat this process until halving the excluded region further fails to prevent lockups.

An example will help to clarify. Suppose your PC—like the one in Figure 2—contains a 32K adapter ROM at C800h that EMM386.EXE failed to identify. Assuming that there are no other adapter ROMs or RAMs occupying space in the C000h and D000h segments and that you've loaded EMM386.EXE with a NOEMS parameter, EMM386 will create 128K of UMB RAM on this PC—64K each in the C000h and D000h segments. Since EMM386 failed to recognize the ROM in the C000h segment, the PC will probably lock up shortly after it's booted.

The first step in resolving the conflict is to exclude the entire C000h segment of memory by installing EMM386.EXE with the line

```
DEVICE=C:\DOS\EMM386.EXE NOEMS
X=C800-CFFF
```

Now load the same program high that precipitated the lockup before, and reboot. You've excluded the entire C000h segment so, if your PC still locks up, you know that the conflict must lie in the

unnecessarily excluded 32K of empty address space that could be converted to UMB RAM. The next step is to narrow the excluded address range further by installing EMM386.EXE with the line

```
DEVICE=C:\DOS\EMM386.EXE NOEMS
X=C800-C7FF
```

This time, the PC will lock up because the half you excluded is not the half that contains the adapter ROM. To remedy this, reload EMM386.EXE with the line

```
DEVICE=C:\DOS\EMM386.EXE NOEMS
X=C800-CFFF
```

After rebooting, you should find that 96K of UMB RAM is available and that lockups do not occur. Further attempts to reduce the size of the excluded region will fail because excluding either half still results in EMM386.EXE converting 16K of space occupied by ROM to UMB RAM.

Simply by making the X=C800-CFFF switch a permanent part of your CONFIG.SYS file, you can eliminate

D000h segment. If the PC doesn't lock up, the conflict lies in the C000h segment. Either way, you have identified 64K of address space that you can safely convert to UMB RAM.

In our test configuration, the PC doesn't lock up when the C000h segment is excluded. So far, so good. You can safely load TSRs and device drivers high, though you've

the conflict between EMM386.EXE and the adapter ROM and still have 96K of UMB RAM in which to load programs. This technique of repeatedly halving the region of memory you exclude from EMM386.EXE works with adapter ROMs and RAMs as little as 4K in length—the smallest region of address space that you can exclude from EMM386.EXE.

WHY CONFLICTS OCCUR Why do these conflicts occur? Because identifying ROM and RAM in the upper-memory area is a tricky business. Adapter ROMs are generally easy to identify because they begin on even 2K boundaries and contain hardware signatures that identify them. The signature consists of a word with the value AA55h at the beginning of the ROM module, followed by a byte that identifies the length of the ROM (in bytes) divided by 512. As a further safeguard, the result of a modulo operation performed between the sum of all the bytes stored in ROM and the value 100h must be 0. (A modulo operation is an arithmetic operation whose result is the remainder of a division operation.) In other words, the sum of all the values stored in ROM must be evenly divisible by 256 or the ROM is not considered valid. Hardware manufacturers typically tweak the value of the final byte so their ROM modules meet this criterion. During startup, your PC's POST (Power-On Self Test), which is contained in system-board ROM, uses the signatures to identify adapter ROMs. If you're a program-

Upper Memory with a 32K Adapter ROM At C800h

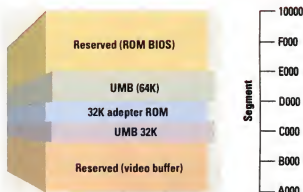


Figure 2: On a PC with a 32K adapter ROM in the upper half of the C000h segment, EMM386.EXE will divide upper memory into two UMBs. Conflicts will occur if EMM386.EXE fails to recognize a region of memory reserved for ROM, and maps a UMB into this space.



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mer, it's relatively simple to use this information to write a routine that identifies all the adapter ROMs in the system.

Adapter RAMs and system-board ROMs are a different story. Neither contain hardware signatures, so they're difficult—sometimes impossible—to identify using just software alone. QEMM-386 and 386MAX use proprietary techniques to identify areas of ROM and RAM between 640K and 1MB, and to reclaim some of the space that is occupied by ROM using technologies such as Stealth (QEMM386) and BIOS compression (386MAX and Blue Max).

These techniques range from simple (performing read/write tests on areas of memory to determine if they hold ROM or RAM) to complex (calling every docu-

mented BIOS interrupt while the processor is in Virtual 86 mode and using the 386 page table entries' page accessed bits to determine which areas of memory were accessed), but none of them are completely foolproof.

Adapter RAM can be especially tricky, because some network adapter cards do not enable their on-board RAM until after the network is accessed. One reason that QEMM-386 and 386MAX are more successful than EMM386 at identifying adapter RAM is that they come with configuration programs you

can run after you've logged on to the network. If you're a network user and you use QEMM-386 or 386MAX, it's important to run the installation and setup utilities for these programs *after* logging on

to the network. Otherwise, their installation programs could miss regions of memory that contain network adapter RAM. EMM386.EXE, by contrast, scans the upper-memory area anew each time it starts up and decides what areas to convert to UMB RAM. It does not come with a configuration utility you can run after the system is started. Therefore, you must resort to trial-and-error procedures like the one described above to resolve conflicts between EMM386.EXE and the hardware installed in your PC. □

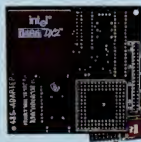
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**System-board ROMs and
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USER TO USER

Repeating Commands Revisited: Executing commands on a list of filenames. Making Exceptions: A batch file that lets you exclude certain files from processing.

BY NEIL J. RUBENKING

Repeating Commands Revisited

This is a rather belated response to an answer given to a question in "Repeating Commands" in the April 10, 1990, issue. In that column you stated that there really is no way to use a list of files rather than a command line argument with a DOS command.

This may be strictly true, but there is a way to do it using only a batch file and commands supplied with all versions of DOS; it doesn't require BASIC or any editor to build the command lines. There are some limitations, and the result isn't fast, but that's the result of DOS's slow batch file processing.

I've called the batch file shown in Figure 1 REPT.BAT, since it will repeat a particular command once for each line in a file of parameters. The batch file itself requires two parameters. The first is the name of a file that contains the command you want repeated. This command file must reside in a fixed subdirectory, C:\BAT, and have the extension .CMD. The command in that file must be followed by a space and must not include a newline character at the end of the line. It must also be the same as the name of the file itself. You can create an ERASE command file using:

```
COPY CON C:\BAT\ERASE.CMD ERASE
<F6><Enter>
```

The second parameter the batch file needs is the name of a file containing a list of arguments (such as filenames), with one line in the file for each time you want the command repeated. *None* of the parameter lines may contain the character sequence used in the command file.

As it works, the batch file creates

three temporary files in the current directory, but these will be deleted when the task is finished, unless the routine is somehow aborted before completion.

The batch file first checks for the existence of the two required files, the command file and the file with the argument list. It copies the file containing the list of parameters to the file TEMPFIL1 and then appends that file to the command file to create a second temporary file, TEMPFIL2. This second temporary file is split into two files, a batch file (TEMP.BAT) that contains just the first line (with the command name at the beginning) and a new version of TEMPFIL1 that contains all the remaining lines. The remaining lines are copied back into the TEMPFIL1 parameter list. This sequence occurs for each of the remaining lines. When all the lines have been used, TEMPFIL1 will have zero length and will be deleted.

At this point, TEMP.BAT will contain one line for each line in the original parameter file, with the required command prefixed to each line. In DOS, Version 3.3 or later, the batch file can now be CALLED and then deleted after execution. In earlier versions of DOS the CALL line will have to be replaced by a line with the word TEMP, and the TEMP.BAT file can't be deleted after it is executed. One possible workaround would be to append the line ERASE TEMP.BAT to the TEMP.BAT file, but this gives an error message from DOS after the file has been deleted.

There are a limited number of DOS commands for which the REPT routine is useful, such as ERASE, COPY, BACKUP, and PRINT, but it can also be used with other programs or batch files. If the file list contains spaces within the

lines, be careful that none of the lines contain the command name followed by a space. For example, if the PRINT command is used, the line SPRINT /B:1000 in the file list will cause problems, since the string PRINT followed by a space is found within the file. If possible, move the filename to the end of the line so it is not followed by a space. Alternatively, put more than one space after the command in the command file and change the FIND string in REPT.BAT so it searches for more than one trailing space after the command.

Arne Rohde
Papakura, New Zealand

► **PC MAGAZINE** The technique illustrated by REPT.BAT has an excellent companion in the new syntax of DOS 5.0's DIR command; with the correct switches, DIR will produce the necessary list of files. The /B switch causes DIR to produce a "bare" listing—just the complete pathname, with no size, date, or time information. The /S switch tells DIR to search the current directory and all subdirectories. So, for example, the command

```
DIR C:\*.BAK /B/S > ALLBAK.DAT
```

will create a file ALLBAK.DAT containing the full pathnames of all .BAK files on drive C:, a file that could be passed to REPT.BAT as input. In addition, the /L switch produces a listing in lowercase. If you make sure to use all uppercase for your command file, the /L switch will eliminate the possibility of FIND accidentally finding the command string within a filename.

REPT.BAT is a general batch file that repeats the command of your choice for each line in an input file. You can apply

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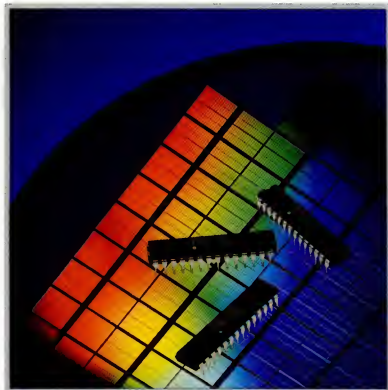


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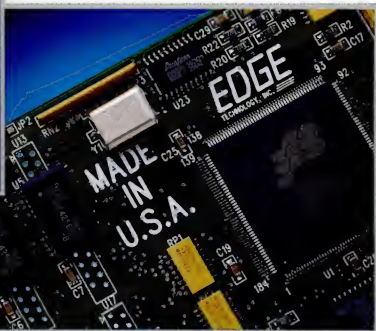
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if '%2'=='' goto erro
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if not exist %2 goto erro
del temp.bat >nul
copy %2 tempfiles >nul
:begin
if not exist tempfiles copy %2
copy c:\bat\%1.cmd+tempfiles tempfill >nul
type tempfill | find '%1' >>temp.bat
type tempfill | find /v '%1' >>tempfill
del tempfill >nul
del tempfiles >nul
del tempfill >nul
goto begin
:erro
echo c:\bat\%1.cmd or %2 does not exist - incorrect parameters
goto exit
:exeq
type temp.bat | more
echo Press any key except Ctrl-Break to execute above commands
pause
call temp.bat
del temp.bat >nul
:exit

```



Figure 1: REPT.BAT takes a file containing a command in a particular format and applies it to every line in another file.

the same techniques to make a batch file for any specific purpose. I wrote DELBAK.BAT, shown in Figure 2, as an example. Pass DELBAK a drive letter and it will build and execute a batch file to delete all .BAK files on that drive.

Both DELBAK and REPT make good use of the fact that DOS's COPY command won't copy an empty file. REPT detects the end of the input file by copying it to another file and checking for that second file's existence. DELBAK does the same and also uses this technique to be sure there are BAK files

DELBAK avoids the waste of space by creating the tiny command file each time it's run. Of course this savings comes at the expense of speed.

DELBAK creates and runs a DEBUG script that in turn creates DELCMD. \$\$\$. The DEBUG script is designed to allow some flexibility: You could plug this code almost unchanged into REPT.BAT, replacing "DEL" with "%1". Yes, the %1 parameter might vary in size, but as long as it's not longer than eight characters, the resulting command file will work. The F command line fills

on the selected drive. The standard IF EXIST test doesn't scan subdirectories, so DELBAK simply creates its list of files and aborts if the resulting file has zero length.

REPT.BAT requires a tiny file such as ERASE .CMD, containing just the desired command, a space, and no carriage return or line feed at the end. That tiny file uses a whole cluster of disk space.

memory at offset 100 with nine spaces, and the E command copies "DEL" (or the command of your choice) to offset 100. Result? The file contains the specified command, padded with spaces to a total of nine characters.

Mr. Rohde is fortunately wrong about REPT needing major modification for use with DOS versions earlier than 3.3. If you're using an older DOS version, all you have to do is replace CALL with COMMAND /C in the third from last line. You'll also have to delete the @ sign in front of the initial ECHO OFF. It's that simple! (You can download the files mentioned here from PC MagNet archived as REPT.ZIP).

Making Exceptions

DOS's FOR...IN...DO command is very useful for selecting specific files to work on, but it would be handy if DOS also supplied a way to exclude certain files from processing. PC Magazine's NO.COM utility does provide this capability, but it's clumsy to use when multiple file specifications are involved. I wrote the batch file EXCEPT.BAT shown in Figure 3 to solve this problem. EXCEPT works by temporarily "hiding" the excluded files while the specified command is executed. The syntax is

```

EXCEPT filespec [filespec [. . .]]
DO action [params]

```

DELBAT.BAT

Complete Listing

```

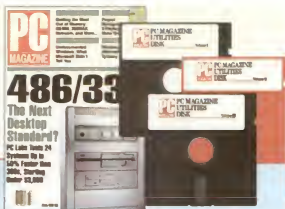
@ECHO OFF
IF '%1'=='' GOTO Syntax
SET drive=
:Be sure the command line parameter is a single letter
: Using /n in front of an item in the FOR list splits the
: first letter of that item from the rest. Only if the
: parameter was a single letter to start with will the
: drive variable have the same value as the parameter.
FOR %%d IN (%1) DO SET drive=%%d
IF NOT '%drive%'=='%1' GOTO Syntax
: Get the list of BAK files on the requested drive
DIR %1\*.BAK /B/S/L > BAKLIST1.$$$
: Make sure the list is not empty
COPY BAKLIST1.$$$ BAKLIST2.$$$ > NUL
IF EXIST BAKLIST2.$$$ GOTO HaveFiles
ECHO There are no BAK files on drive %1:
DEL BAKLIST1.$$$
GOTO End
:HaveFiles
: Creates the DELCMD. $$$ file
REN %TEMP%.BAT
ECHO DELCMD. $$$ > MAKEDEL.SCR
ECHO F 100 L 9 " " >> MAKEDEL.SCR
ECHO E 100 "DEL" >> MAKEDEL.SCR
ECHO RCX >> MAKEDEL.SCR
ECHO 9 >> MAKEDEL.SCR
ECHO W >> MAKEDEL.SCR
ECHO Q >> MAKEDEL.SCR
DEBUG < MAKEDEL.SCR > NUL
DEL MAKEDEL.SCR

: Build a batch file containing each of the filenames
: with "DEL " in front of it.
loop
: Prefix the first line of the list with "DEL "
COPY DELCMD. $$$ > BAKLIST2.$$$ > NUL
: Use FIND to extract that first line into a new file
TYPE BAKLIST2.$$$ | FIND "DEL " > BAKLIST3.$$$
: Show the new file
DEL BAKLIST3.$$$
: Append the DEL command line to TEMPDEL.BAT
COPY TEMPDEL.BAT > BAKLIST3.$$$ > NUL
DEL BAKLIST3.$$$
: Copy all lines "except" the first back to the original list
TYPE BAKLIST2.$$$ | FIND /V "DEL " > BAKLIST1.$$$
DEL BAKLIST2.$$$ > NUL
: Check whether the original list is empty
COPY BAKLIST1.$$$ BAKLIST2.$$$ > NUL
IF EXIST BAKLIST2.$$$ GOTO loop
: Reach this point when the list is empty
DEL BAKLIST1.$$$
DEL DELCMD. $$$
ECHO Press Ctrl-Break if you do "NOT" want to delete BAK files, or
PAUSE
CALL TEMPDEL.BAT
DEL TEMPDEL.BAT
GOTO End
:Syntax
ECHO Syntax: "DELBAT d", where d is a lone drive letter
:End

```



Figure 2: DELBAK.BAT deletes all .BAK files on a particular drive using the techniques introduced in REPT.BAT (Figure 1).



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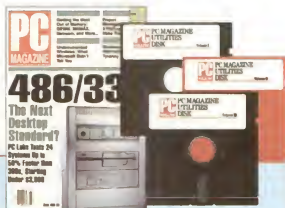
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EXCEPT.BAT

Complete Listing

```

@ECHO OFF
IF EXIST c:\except$.bat DEL c:\except$.bat >NUL
:Loop
FOR %* IN (do do do do) DO IF %1==%* GOTO Dolt
IF %1== GOTO Syntax
IF EXIST %1 ECHO ATTRIB %1 %1 >>c:\except$.bat
SHIFT
GOTO Loop
:Dolt
IF %2== GOTO Syntax
FOR NOT EXIST c:\except$.bat GOTO Syntax
ATTRIB -h c:\except$.bat
CALL c:\except$.bat >NUL
CALL %2 %3 %4 %5 %6 %7 %8 %9
CALL c:\except$.bat >NUL
ATTRIB -h c:\except$.bat
GOTO End
:Syntax
ECHO Syntax: EXCEPT filespec [[filespec [...]] DO action [params]
:End
IF EXIST c:\except$.bat DEL c:\except$.bat >NUL

```



Figure 3: This batch file lets you specify files to exclude from being processed by a command. It is a good complement to DOS's FOR . . . IN . . . DO command.

where *action* may be any .COM, .EXE, .BAT file, or any internal DOS command, with *params* as its command line switches or parameters. The *filespec* file specifications can include wildcards as well as a path. The number of filespecs to be excluded from the action is limited only by the length of the DOS command line.

Suppose, for example, you want to copy all files in the current directory *except* those with extensions .TXT, .DOC, and .WRI to drive A:. Just enter the line:

```

EXCEPT *.TXT *.DOC *.WRI DO COPY
*.* A:

```

If you want to work on files in a directory other than the current one, you need to either provide the complete path for both files and the parameters or to change to the directory where the files are located. If you use EXCEPT to run a batch file that includes a change in directory, the batch file should return to the original directory upon exit. Finally, as with NO.COM, EXCEPT.BAT does not work with DOS's RESTORE/BACKUP operations.

Arnell P. Reyes
Los Alamos, New Mexico

► **PC MAGAZINE** I'm a big fan of the venerable NO.COM (which was published in the May 13, 1986, issue of *PC Magazine*). For example, I archive all of my old articles in .ZIP files. To check for "loose" files that haven't been archived, I just type NO *.ZIP DIR—that's all it takes!

But I'm pleased to see the same task accomplished using nothing but batch commands. And indeed, using NO.COM with multiple file specifications is awkward, because you have to stack up multiple calls to the program. For instance, to handle the task in Mr. Reyes's example, the command would look like this:

```

NO *.TXT NO *.DOC NO *.WRI COPY
*.* A:

```

Both EXCEPT.BAT and NO.COM work by hiding the files to be excluded, performing the desired operation, and then un-hiding them. Note that both could conceivably cause problems if the file specifications match any files that should remain hidden.

EXCEPT.BAT hides and un-hides files by calling a temporary batch file (EXCEPT\$.BAT) that it builds from the file specifications on the command line. Each time through the loop that starts at the label Loop, it checks whether the first parameter is DO. If so, the list of file specifications is over. It also checks whether the first parameter is nonexistent, meaning the user entered the command line improperly.

If the first parameter is not DO and some files exist that match it, EXCEPT.BAT generates a line for the temporary batch file. It appends the output of the command ECHO ATTRIB %1 %1 to the temporary batch file. DOS interprets the double percent sign as a single percent and replaces %1 with the value of the first parameter. If the first parameter

was *.COM, the result would be ATTRIB %1 *.COM. The SHIFT command shifts all the parameters down by one and reads a new ninth parameter from the command line if available. Then the batch file jumps back to the label Loop to process the new first parameter.

As long as the DO parameter is present to end the list of file specifications, the lines after the label Dolt get executed. More error-checking takes place here. If the second parameter is empty, it means no action was specified after the DO parameter, and if the temporary batch file doesn't exist, no file specifications were present before the DO parameter. Assuming no errors, the three lines beginning with CALL actually carry out EXCEPT.BAT's work.

EXCEPT uses the ATTRIB command to hide the temporary batch file, just in case it matches one of the file specifications. It then CALLs the temporary batch file with a parameter of +h, which has the effect of hiding all files that match any of the file specifications. The next line CALLs the action command, passing as many as seven parameters. If this command is not a batch file, using CALL is unnecessary, but harmless. Finally, EXCEPT CALLs the temporary batch file again to unhide the specified files and uses ATTRIB to unhide the temporary batch file itself. The last line cleans up by disposing of the temporary batch file.

You could rewrite EXCEPT.BAT so that it would use a FOR loop to process all the matching files rather than building and executing a temporary batch file, and you'd think that would speed up the batch file's operation. But doing so involves one call to ATTRIB for each matching file, instead of one call for each file specification, and this counteracts the speed benefit of avoiding a temporary batch file. □

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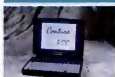
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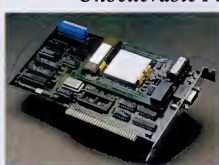
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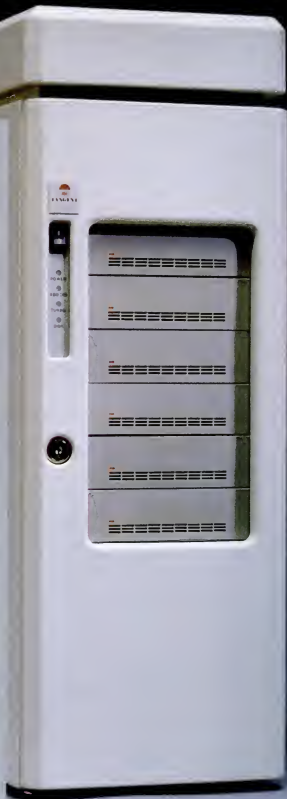
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CIRCLE 045 ON READER SERVICE CARD

CONNECTIVITY

LAN Cable Specifications: Examining the multitude of network cabling standards.

BY FRANK J. DERFLER, JR.

LAN Cable Specifications

A salesperson recently told us that the unshielded twisted-pair LAN cable they sell meets Underwriters Laboratories' Level V specifications. I'm confused by all the different cable specifications anyway, but since LAN cable is hardly an appliance, should I worry about UL certification?

William Hardy
Los Angeles, California

► **PC MAGAZINE** It seems that every organization even remotely concerned with networking has issued standards or guidelines for LAN cabling. The National Electrical Code describes various types of cables as well as the materials used in each. IBM has a family of cable specifications. The Electronic Industries Association/Telecommunications Industry Association (EIA/TIA) has issued EIA/TIA 568 and 569 standards for technical performance and maintains an active program to extend their requirements. The IEEE includes minimal cable requirements in its 802.3 and 802.5 specifications for Ethernet-like and Token-Ring systems.

Underwriters Laboratories focuses on safety standards, but it has expanded its certification program to evaluate twisted-pair LAN cables for performance according to IBM and EIA/TIA performance specifications as well as according to National Electrical Code safety specifications. UL established a program to mark shielded and unshielded twisted-pair LAN cables that should effectively simplify the complex task of making sure the materials used in the installation meet specifications.

Note that simply using the right mate-

rials doesn't insure that an installation will meet the performance specification. Many factors determine the quality of the total installation, including how much the wire is untwisted before it reaches a terminal block, the type of terminal block, the electrical noise in various frequency bands, and the near-end crosstalk (NEXT) caused by wires in proximity to each other. But you can get a good start

*The UL has established a
program that should
simplify the complex task of
making sure the materials
used in LAN cables are
up to specification.*

on a good installation by using the correct cable.

UL refers to its designations as *markings*, and these markings range from Level I through Level V. IBM's cable specifications extend from Type 1 through Type 9 while the EIA/TIA has proposed Categories ranging from 1 through 5. It's easy to become confused by the similarly numbered levels, types, and categories. The IBM *type* specifications include descriptions of the configuration of each cable type, such as two pairs of 22 AWG shielded non-plenum cable. The UL *level* markings deal with performance and safety, but they don't specify the details such as shielded or unshielded wire included in the IBM specifications. The emerging EIA/TIA *categories* will focus on performance in

a manner similar to the UL levels.

Cables certified with UL Level I and II markings meet safety requirements, but the lower level markings don't tell you much about performance. The primary difference between cables with Levels III, IV, and V markings is in the maximum amount of attenuation and crosstalk allowed in different frequency bands. Cables with higher-number markings have lower attenuation and crosstalk and will typically allow higher practical signaling speeds through the wiring system.

The UL certification marking level isn't all you need to know about a cable—you still must provide other specifics to define its exact configuration. The UL certification also begs the question, "What is the minimum level marking I need for the cables in my installation?" The answer is that Level III is probably good enough for all of today's installations. But if someday you plan to run 100 megabits per second over your copper cable system, then you should price cables with higher certification levels to determine whether or not an investment today is worth improved performance in the years to come. □

NETWORK YOUR QUESTIONS

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SPREADSHEETS

Excel Sheets with Style: Need to change the format for a group of cells at once? Use styles. **Text-Sorting Quirks:** How major spreadsheet programs alphabetize.

BY CRAIG STINSON

Excel Sheets with Style

Excel 2.1 had a great feature that enabled me to replace every occurrence of a particular font with another font. Version 3.0 apparently did away with this, forcing me to highlight each cell involved before changing fonts. This is fine if the cells I want to change are contiguous, but that's usually not the case. Is there an undocumented way to do what I'm describing, using Version 3.0?

Doug Kanter
Rochester, New York

► PC MAGAZINE Neither Excel 3.0 nor Excel 4.0 has exactly what you're looking for: a Replace command that lets you search and replace on the basis of formatting attributes. Many word processors offer that service; to my knowledge, no spreadsheets do.

You can achieve the font replaceability you're looking for, but it may require a change in your worksheet-building habits. The key is to use *styles*. You can do this in either Excel 3.0 or Excel 4.0.

Let's say you've just entered a series of column-heading labels and formatted them in 12-point MS Sans Serif bold. To make this font "replaceable," click once on the Style box (the text field near the left edge of Excel's standard toolbar, in either version) and type a name, such as *Headings*. This action creates a "style by example." The next time you want to apply 12-point MS Sans Serif bold to a cell or range on this worksheet, instead of going for Format-menu commands, click the arrow to the right of the Style box and choose *Headings* from the list that unfolds.

Applying your defined style to all examples of this formatting combination

gives you the freedom to change your mind. If you decide you want all instances of 12-point MS Sans Serif bold to be replaced by 12-point Times New Roman bold italic, all you have to do is redefine the style. To do that, pull down the Format menu, choose *Style*, and select the name of the style you want to redefine. Then click the Define button, followed by the Font button. A normal Excel font dialog box will appear. Make your changes, click OK, and your font will be replaced throughout the worksheet.

The styles approach to font replacement does force you to think ahead a bit. In return for that, though, you get the ability to use (and replace at will) any font installed on your system, not just the four fonts that Excel 2.1 offered. More important, perhaps, you can also apply many other formatting attributes—borders, patterns, numeric display formats, alignment settings, and protection settings—to named styles and replace them at will.

Text-Sorting Quirks

I recently discovered an interesting quirk regarding sorting in Lotus 1-2-3, Release 3.1. According to the manual, Release 3.1's default collating sequence is "Numbers First," which means that 1-2-3 will sort your data in the following order (if you select an ascending sort):

1. Blank cells
2. Labels that begin with a space character
3. Labels that begin with numbers
4. Labels that begin with letters
5. Labels that begin with other characters
6. Values

However, there is an interesting exception to this order: 1-2-3, Release 3.1,

puts labels beginning with an apostrophe (not the label prefix character but a visible apostrophe) or a hyphen before any labels that begin with a space! While this may not create problems for most users, it results in some strange sorting of labels that include embedded spaces, hyphens, apostrophes, or other punctuation symbols.

For example, let's say you want to sort the following names:

Doe, John
Doe Jr., John
Doeman, John

If you perform this sort in Release 3.1, you will get this:

Doe Jr., John
Doeman, John
Doe, John

The separation of Doe Jr. from plain Doe is probably not what you want.

Release 2.x treats the sorting order a bit differently. It puts commas before spaces and all alphabetic characters before the apostrophe. The same three names in 1-2-3, Release 2.x, would be sorted as follows:

Doe, John
Doe Jr., John
Doeman, John

This keeps the members of the Doe family together, which is probably more desirable. On the other hand, when it comes to names with embedded apostrophes, Release 3.x's approach may be more satisfactory. In Release 3.x, you get O'Brien before Owens, which is what you would see in a properly alphabetized index. In

Release 2.x, Owens comes before O'Brien.

Both versions of 1-2-3 also provide an alternative "ASCII" collating sequence that sorts all labels according to their ASCII values. If you use this option, you'll get the same results in both Release 2.x and 3.x. But names with internal capitals will be incorrectly sorted. For example, DeJohn, Jane will appear before Deans, Karen.

Raymond Chow
Foxridge, Maryland

► **PC MAGAZINE** What Mr. Chow says is quite right. Release 3.x (and also Lotus 1-2-3 for Windows) sorts differently from Release 2.x, and the Release 3.x Reference's description of its sort order (page 2-76) does not mention the program's peculiar treatment of spaces and apostrophes. Sorter and upgrader beware!

A comparison of these two versions of 1-2-3 with Quattro Pro 4.0 and Excel 4.0 reveals some other amusing disagreements. Figure 1 shows how the Does and Doemans would be sorted in each of the four major spreadsheet products. (This example assumes that all programs are set for an ascending sort in "dictionary," as opposed to "ASCII," order.)

Simple combinatorial logic tells us that three distinct items can be ordered in six different ways (ABC, ACB, BAC, BCA, CAB, and CBA). Our four major spreadsheet programs have laid claim to three of those variations!

Users who have made the move from 1-2-3, Release 2.x, to Quattro Pro should note that Quattro Pro in this case

matches Release 3.x's sorting algorithm, not Release 2.x's. (In most cases, where there are differences between Release 2.x and Release 3.x, Quattro Pro follows the pattern of 2.x.)

When it comes to the sorting of embedded hyphens and commas, however, Quattro Pro matches Excel and shuns both Lotus models. Figure 2 shows how each of our four spreadsheet programs would carry out an ascending sort of the labels "Dow, Charles", "Dow theory", and "Dow-Jones".

As for the sorting of embedded apostrophes, Release 3.x and Excel both put O'Brien ahead of Owens, while Quattro Pro and Release 2.x do the opposite. (Here, finally, we have the expected match of Quattro Pro and Release 2.x; unfortunately, most indexers would consider both programs' behavior incorrect.)

There are peculiarities in the handling of capital letters, too. In a dictionary sorting order, should a lowercase letter have higher or lower priority than its uppercase counterpart? There may be no obvious answer, but one would expect a program to have some consistent policy in the matter.

Release 3.x does. True to its documentation, Release 3.x always sorts a lowercase letter before its capital equivalent. Excel and Release 2.x, on the other hand, leave the matter up to you. If your list of names includes Dejong and DeJong, these programs' sort commands will treat these variants as exact equivalents and leave them exactly as they stand.

Quattro Pro also seems to regard the uppercase and lowercase variants as equivalent. But for some reason it prefers to flip them. If you now have Dejong before DeJong, an ascending sort will reverse the two names. A second ascending sort will put them back in their original positions, and so on. Sorter beware!

One additional bit of trivia may be nontrivial to Excel upgraders: Microsoft changed Excel's sorting order when it began shipping an interim version of Excel 3.0: Version 3.0a. Versions prior to 3.0a adhere to the classic ASCII and ANSI sequence of punctuation symbols and alphabetic characters. That is, some of the punctuation symbols precede the alphabet and some follow it. Excel 4.0 uses a more rational sequence in which all the punctuation symbols have higher priority

Spreadsheet Sorting Order, Part 2

1-2-3 Release 2.x

Dow, Charles
Dow theory
Dow-Jones

1-2-3 Release 3.x and 1-2-3 for Windows

Dow theory
Dow-Jones
Dow, Charles

Excel 4.0

Dow theory
Dow, Charles
Dow-Jones

Quattro Pro 4.0

Dow theory
Dow, Charles
Dow-Jones

Figure 2: These examples show how the spreadsheet packages sort labels containing hyphens, commas, and spaces.

than the alphabetic characters. If you're now working in Excel 4.0 and want the program to behave as 3.0 did, you can add the line sort=2 to your EXCEL.INI file.

One thing (and perhaps only one) should be obvious from this quick survey of sorting quirks: Spreadsheets are not meant to be indexing programs. They're dandy at putting numbers into correct sequence; for example, they have no problem ordering numbers by their magnitude, regardless of how the numbers are formatted. But if you care about formalities, you should treat any spreadsheet-sorted list of names as a starting point, not a finished effort.

You can find authoritative information about how personal and place names should be sorted (spelled out in thrilling detail) in *The Chicago Manual of Style*. After you've spent a few moments there, you may never again be tempted to do an index of anything. And you certainly won't worry about whether your spreadsheet is more alphabetically correct than your neighbor's. *The Chicago Manual* makes it quite clear: They're all wrong. □

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Spreadsheet Sorting Order, Part 1

1-2-3 Release 2.x

Doe, John
Doe Jr., John
Doeman, John

1-2-3 Release 3.x and 1-2-3 for Windows

Doe Jr., John
Doeman, John
Doe, John

Excel 4.0

Doe Jr., John
Doe, John
Doeman, John

Quattro Pro 4.0

Doe Jr., John
Doeman, John
Doe, John

Figure 1: These examples show how four major spreadsheet packages sort text labels containing spaces, commas, and letters.



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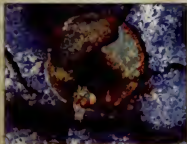
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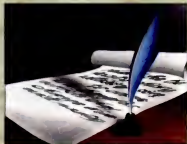
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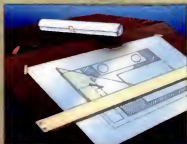
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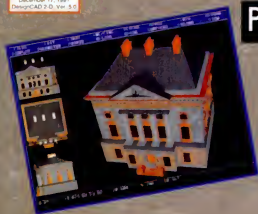


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THE WORKING WORD

Watermarks in WinWord: Stamp over your Microsoft Word for Windows documents with a banner of text or graphics descending from the header.

BY M. DAVID STONE

Watermarks in WinWord

There are situations where it would be useful to have a word like *Confidential* appear in big gray letters across a page, as a background to the actual text of the document.

I have tried to do this with Microsoft Word for Windows 2.0 by inserting WordArt text in the document header, but this doesn't seem to work. Is there a way to achieve this type of effect, or is this impossible in Word for Windows?

Roeland Mertens

Blumenthal, Luxembourg

► **PC MAGAZINE** The effect you're looking for is known in WinWord as a *watermark*. To create a watermark, you have to tell WinWord to let the header overlap with the body of the document. Otherwise, it will follow the default of expanding the top margin, and will push body text down the page to make room for the WordArt object in the header.

The basic technique is simple enough, and it's even mentioned in the WinWord manual (on page 227), but I'd bet Mr. Mertens isn't the only user who couldn't find it there. Even if you know about watermarks, creating pages like the ones shown in Figure 1 is less straightforward than you might expect.

The secret to telling WinWord to print the header so that it overlaps the body of the document is simply to enter the top margin with a minus sign. For example, if you want a 1-inch top margin that will stay at 1-inch no matter how much information you've put into the header, choose Format, Page Setup, Margin, and set the Top margin to -1".

You can also anchor watermark images in the footer of your document. As

with the header, the footer will, by default, expand the bottom margin to accommodate anything you've placed in the footer, but as with the header, too, you can override the default: Simply enter the bottom margin with a minus sign. For the purpose of this discussion, I'll assume you're putting the watermark in the header, but the procedure given here also applies to using the footer.

Note that WinWord, Version 1.x, pro-

enhancements. The reason for this is that you can only see the watermark image on the editing screen when you have WinWord set to push the body text out of the way. If you override the program default for expanding the margin before creating the watermark, the watermark image will be hidden by the body text, making it impossible to resize or move. Another thing to be aware of is that you cannot see, resize, or move the watermark image from Normal view; you must be in Page Layout view.

To create a watermark with a Word Art object anchored in the header, start by making sure that the top margin entry does not include a minus sign. Next choose View, Page Layout, to ensure that you're in the correct view. If you already have a header in the document, you can move the cursor there directly. Otherwise, choose View, Header, then select Header from the list in the Header/Footer dialog box, and choose OK.

With the cursor in the header, choose Insert, Object, then select MS WordArt and choose OK. (The technique would also work with another type of object such as a Picture or Drawing.) Once in WordArt, create the text for the watermark using whatever font and enhancements you like. Experiment with the different possibilities, because the exact effect will vary somewhat depending on your printer. The pages shown in Figure 1 were both printed on an HP LaserJet Series II printer. You may get somewhat different results if you're using another type of printer. Some printers will produce lighter shades of gray for any given fill, for example.

Differences among printers aside, you may want to start with the same settings used for these examples. The left-hand

*The secret to telling
WinWord to print the
header so that it
overlaps the body of
the document is simply
to enter the top margin
with a minus sign.*

vides the same ability to create a watermark by including a minus sign in the top or bottom margin: Choose Format Document to set the margins. To create a watermark in WinWord 1.x, however, you have to use an external graphics package, such as Publisher's Paintbrush from ZSoft Corp., and import the image with the Insert Picture command. For this discussion, I'll assume you're using WinWord 2.0 and WordArt.

To take advantage of the ability to overlap the header and body text, it's important that you don't enter the minus sign for the margin until after you've finished creating the watermark and are fully satisfied with its size, placement, and

August 12, 1992

Deanne Tanner
216 Promotion Place
Chapin, New York 12345

Dear Deanne Tanner:

As I'm sure you are aware from your frequent travels aboard Blue Sky Airlines, we produce a quarterly magazine for our passengers to read while in flight. As the marketing representative for Blue Sky's publications, I am inviting you to be our Spring Spotlight Passenger.

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I would like to schedule the interview for a time that is convenient for you. I will call you during the coming week to discuss the details with you. If you have questions before then, please feel free to call me at (555) 555-5543.

Complutations, Deanne!

Sincerely,

Julia Lombard
Marketing Representative
Blue Sky Airlines

FilmWatch Division Marketing Plan

Introduction

The Trey Research FilmWatch Division represents a new opportunity to dominate market research for the industry. This new Trey Division will be created by research organizations devoted exclusively to market research and analysis for motion picture industry.

Markets

We see two main target markets:

Market 1

- Producers who want to test the appeal of actors, actresses, locations, and so forth prior to filming.

Market 2

- Film companies who want to know the effect of different endings for films that have not yet wrapped.

Advantages

FilmWatch offers two major advantages for motion picture producers:

Advantage 1

- Objectivity and the ability to quantify results

Advantage 2

- Expertise in consumer research and analysis

Objectives

There are two objectives to be realized within six months to one year of the official launch of FilmWatch as a separate division. If possible, the objective should be achieved before FilmWatch is spun out.

Market Reception of the Division

FilmWatch should be perceived by the market and by the film industry trade press as the "authority" in motion picture

Figure 1: You can create watermarks like those in your WinWord documents by inserting WordArt objects into the document's header. The watermark on the left-hand page is in the Anacortes font with white fill, and the one on the right is in the Bellingham font with light gray fill.

page in Figure 1 uses the word *Draft*, with Font set to Anacortes, Size to Best Fit, Style to Slant Up (More), Fill to white, and Align to Letter Justify. The right-hand page shows a *Confidential* watermark, using the Bellingham font and a light gray fill.

When you finish creating the WordArt text, choose OK to close the WordArt window and return to your document with the WordArt image now inserted. Then select the object by pointing with the mouse and clicking the left mouse button or by holding down the Shift key and using the arrow key to extend the selection. When the object is selected, you'll see a box around the text, with eight small squares, or handles.

You can then resize the object by grabbing the handles and moving them. Point to a handle and, holding down the left mouse button, move the mouse and release the button to set the new size. To achieve the effect shown on the two pages in Figure 1, drag the box handle to the bottom of the page. Alternatively, you can resize the object by choosing Format,

Picture, and setting the size in the Width and Height text boxes. You adjust the leftmost position of the object by adjusting the left margin setting for the paragraph the object is in.

Once you're satisfied with the size and position of the watermark, move the cursor out of the header and back into the document text, choose Format, Page Setup, and then the Margin option button, and add a minus sign to the beginning of the top margin setting. Then choose OK to close the dialog box and return to the document.

At this point, depending on how you positioned the watermark, you may not see it at all, or you may see just a piece of it showing in the top margin. If you go back to Normal view, by choosing View Normal, you won't see it at all unless you choose to view the header. But the watermark will be there, and will print.

If you have a PostScript printer, there's one other variation you'll want to know about. WinWord ships with a macro called WaterMark in NEW-

MACRO.DOC. The macro takes advantage of essentially the same techniques I've discussed here. Instead of inserting a WordArt object into the header, however, it inserts a Print field code. The field code sends a short PostScript program to the printer in order to create the watermark image.

In the next installment of this column, in response to another reader's letter, I'll discuss the watermark macro, along with other macros that ship with WinWord. □

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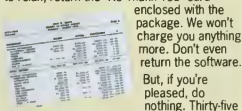
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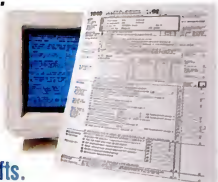


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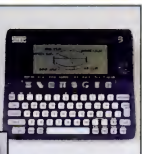


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PC MAGNET

Windows 3.1 Utilities: Our on-line service has software that lets you take full advantage of the environment

BY REED BUTLER

With the release of Microsoft Windows 3.1, shareware authors have produced a host of programs that enhance the Windows environment—everything from diagnostic information to after hours fun. In this column we'll tell you about a few such popular downloads available on PC MagNet and ZiffNet.

If you're curious about your machine's performance while it's running Windows, two tools that can help you measure your system's resources are WINBENCH and SYSUSE. These utilities will help you make informed decisions about upgrading or simply about how many minimized programs you can run at once.

WINBENCH refers to the PC Magazine Labs graphics performance tests for Windows. It is a standalone system evaluator that provides a series of memory and disk tests that let you compare your machine's performance to a predetermined base performance level. Reports can be generated against benchmark comparisons or by speed and timing measurements of specific system resources. It is a valuable source for determining the strengths and weaknesses of your setup and helping you decide where your upgrade dollars would best be spent.

SYSUSE is a real-time system resource monitor that you load in either your WIN.INI file or your Startup group

and configure to run minimized. It will then track CPU, memory, disk, and total resource usage, either in a numeric display while the program's window is open or as a bar-graph display on the program's icon while the program is minimized. Running SYSUSE minimized is especially convenient for tracking the percentage of system use while opening, closing, and executing programs.

One of the most frustrating things about Windows 3.1 is the lack of a speaker driver that would allow you to hear the .WAV sound files that come with the Windows 3.1 package. PC-SPEAKER is a device driver that allows .WAV files to be heard over the PC's rudimentary speaker system. While it hardly rivals the sound quality of a good sound board and quality speakers, it does let you hear sounds other than the simple PC beep.

SOUNDWAV and AUTOWAV allow you to fix, randomize, or pattern the execution of a group of .WAV files. This can be a lot of fun if you're tired of hearing the same sound for the same action every time you use Windows. SOUNDWAV, the main configuration program, lets you assign files to sounds, set multiple directories for .WAV file libraries, play the sounds to test them, and choose whether the sounds' files are to be fixed, selected randomly, or selected sequentially in ascending alphabetical order.

AUTOWAV swaps the WIN.INI System Sound file names for those sounds you have set up with SOUNDWAV as random or sequential. You can launch it at any time by double-clicking

on its icon. As AUTOWAV is neither a TSR nor a Windows background task, it carries no system overhead. It works by writing file information back to your WIN.INI file from its own SOUNDWAV.INI file, and executes quickly and transparently. SOUNDWAV requires VBRUN100.DLL, the Visual Basic dynamic link library, which is not included in the archive (see list below for location). Registered owners of SOUNDWAV receive over 10MB of high-quality, newly recorded .WAV files at no extra cost.

For those of us who need a break from real work at the computer, there's WINTREK—one of the hottest Windows games around. You command the bridge of the starship Enterprise, and your mission is to get to your destination in time and intact. That's not an easy feat with this game, but trying to accomplish it is great fun. You have control over all the starship's resources, and you'll find the real key is to reserve enough of your lithium crystals to keep your shields, phasers, and warp engines operational. WINTREK features readouts of all your systems so you can balance resource use, a grid map to help you locate your enemies and map a route to Starbase, and some feisty alien commanders skilled at search-and-destroy. Be prepared for some enjoyable hours with this one.

FINDING THESE FILES You can access ZiffNet from any CompuServe! prompt simply by typing GO ZNT: followed by the name of the area you want to access. Figure 1 shows where you can find the files mentioned in this column. There is a monthly fee of \$2.50 for ZiffNet membership. Connect-time charges for access to file downloads and other features are at the standard hourly rate of \$6.30 for 300-bps service, \$12.80 for 1,200-bps and 2,400-bps service, and \$22.80 for 9,600-bps service. □

Windows 3.1 Utilities on PC MagNet

Program	Filename	Forum	Library
PCSPEAKER	SPEAK.ZIP	UTILFORUM	LIB 10 WINDOWS
SOUNDWAV and AUTOWAV	SNWAV.ZIP	UTILFORUM	LIB 10 WINDOWS
SYSUSE	SYSUSE.ZIP	PBS	LIB 2 WINDOWS
VBRUN100.DLL	VBR100.ZIP	PBS	LIB 2 WINDOWS
WINBENCH	WINBEN.EXE	UTILFORUM	LIB 3 LAB NOTES
WINTREK	WNTREK.ZIP	AFTERHOURS	LIB 3 GAMES

Figure 2: To get to the files mentioned in this article, type GO ZNT: followed (without a space) by the Forum name listed here.



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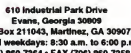
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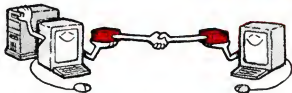
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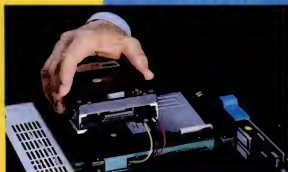
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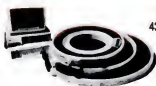
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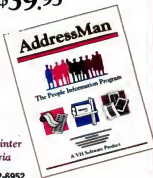
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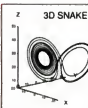
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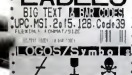
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☐ 01. Yes ☐ 02. No
- Please indicate your company or organization's primary business activity: (Check one only)
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☐ 09. Education
☐ 10. Government—Federal
☐ 11. Government—Non-Federal
☐ 12. Research and Development
☐ 13. Data Processing/Computer Service
☐ 14. Health/Medical/Legal Service
☐ 15. Engineering/Architecture
- Please indicate your primary business function: (Check one only)
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☐ 03. Communications
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☐ 99. Other
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☐ 01. 0 or less ☐ 03. 25-99
☐ 02. 1-25 ☐ 04. 100 or more
- Are there any PCs in your office? (Check all that apply.)
☐ 01. Linked to mainframe
☐ 02. Linked to mini
☐ 03. Networked together
- Please check the equipment currently installed at your location: (Check all that apply)
☐ 01. IBM or Compatible PCs
☐ 02. IBM or Compatible Mainframes
☐ 03. IBM or Compatible Minis
☐ 04. Macintosh
☐ 05. CD-ROM
☐ 06. Windows
- Do you plan to buy any PCs? Products?
☐ 01. Now
☐ 02. In 4 to 6 months
☐ 03. In 7 to 12 months
☐ 04. No definite plans
- Number of Employees in your entire company:
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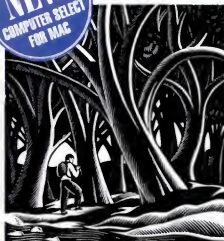
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Coming Up

PC MAGAZINE'S 9TH ANNUAL PRINTER ISSUE

Mainstream Lasers

RISC processors, HP PCL 5, 600-dpi resolutions, smoothing technologies: They aren't standard on all 34 mainstream lasers we review, but they're becoming important in the marketplace. Vendors targeting the small to medium-size workgroup market are also thinking about optimizing their printers for networks.

Network Lasers

For big networks, you need big printers. The printers in this section handle anywhere from 12 to 30 ppm. Some offer network interfaces, heavy duty cycles, multiple paper cassettes with large capacities, and duplex printing. This year, continuous-form lasers that satisfy special needs enter the competition.

Color PostScripts

Dye-sublimation printers enter the color PostScript arena for the first time this year. The promise of such printers lies in their photo-realistic color output, but can they satisfy the needs of the mainstream business user as well as their competitors do?

Ink Jets

The big news in ink jets this year is color, but monochrome ink jets continue to prove their worth—particularly if you're looking for one printer to serve on the desktop and on the road.

Dot Matrix

The biggest advantage dot matrix printers have is their low cost. Some sell for under \$200 on the street, making them viable options for small and home businesses.

Networking/Communications: Print Servers

As many as 70 percent of networking problems are printing problems—and most begin with print server foul-ups. PC Labs puts NetWare 3.11-compatible print servers to the test.

Printer Service: How Good Is It?

Which vendors' printers rate highest among PC Magazine readers? Find out in our Printer Service and Reliability Survey. □

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After Hours

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BRIDGE

Choose Your Perfect Bridge Partner: Three Games with Smarts and Style

BY DON TRIVETTE

Every evening thousands of people across the country get together to socialize and enjoy a few hands of bridge. But what do you do if you need a fix and you can't find the partners, or if you simply haven't learned the art of the game?

Three newly introduced bridge programs—Bicycle Bridge, Bridge 7.0, and Grand Slam Bridge II—can offer you the solution.

Each of these games has characteristics as distinctive as a human counterpart, though all make worthy partners. Bicycle Bridge has the smoothest, most attractive interface, and it plays at about the same level as I do. In other words, it makes stupid blunders. Bridge 7.0 is the most skillful player and it has features that Bicycle Bridge lacks, but the graphics annoy me. Grand Slam II has the most comprehensive options, is an excellent bidder, and plays the game well, but its mouse interface is slow. Whether you prefer brains or beauty, these games let you choose.

BICYCLE BRIDGE

The crisp cards and excellent table organization are the first things you will notice about

Swift International's Bicycle Bridge. The bidding window is first rate and the play is fast. This is the only program that automatically displays your point count at the deal—a helpful feature for novices, the intended market for this game. But this program is less skillful than the others in this group. Bicycle Bridge's bidding skill is sophomoric, and it knows nothing of conventions. In one instance, it passed my demand open at the two level; in another, it inexplicably jumped my three spades to six. (We went down.) This program badly needs a command for correcting or overriding both the bidding and the play.

Perhaps Bicycle Bridge's greatest shortcoming is that it doesn't let you control the deal. Other bridge software allows you to set the number of

points in a hand, and specify a game hand or a slam hand, but not Bicycle Bridge. All hands are dealt randomly. Though you can't enter a custom hand, you can hit the Deal Again button until you get a decent hand.

Your partner's occasional erratic bid will cause you to welcome the you-bid-it-you-play-it mode. Use this option

its attractive graphics and smooth interface. (Yes, I would rather play with a sociable, attractive partner of doubtful skill than a brilliant curmudgeon.)

This software is only available as a bundled package with four other Bicycle card games for \$69.95. In January 1993, Swift International will begin selling it separately for \$49.95.

By then, you will get a Windows version along with the DOS version. My recommendation: Wait. Maybe Swift will add some features.

Bicycle Bridge, \$69.95.
 Requires: 512K RAM, DOS 3.0 or later; mouse recommended. Swift International Ltd., 724 Yorklyn Rd., Hockessin, DE 19707; 800-237-9383, 302-234-1740; fax, 302-234-1760.

Circle 461 on reader service card.

BRIDGE 7.0

The latest version in Artworx's 11-year-old bridge series is both smarter and prettier than earlier versions of the same game. Bridge 7.0 contains more than twice the previous version's code for bidding and playing, and features VGA graphics and mouse support. It's even optimized for laptop computers with LCD displays.

There's no excuse for getting a poor hand in Bridge 7.0. You can specify the number of points in your hand or you can use the hand editor to enter the cards for each player. This feature makes it convenient to copy hands from the newspa-



Clever but quirky: Bridge 7 is a skillful player with some minor interface quirks.

to make North (your electronic teammate) play the hand it initiated. If North makes a dumb bid and gets the contract, for example, you can make him play it. But however satisfying that might be, be forewarned that North plays like a novice; he doesn't know how to finesse or how to set up a cross-trump. There is no automatic mode that will play out a game, as there is in both Bridge 7 and Grand Slam II. A hint button will make a suggestion when you need help with a play.

Bicycle Bridge is not a great player, and it lacks many features; nevertheless, I keep returning to it time after time simply because of



A pretty face: What Bicycle Bridge lacks in finesse, it makes up in playability and interface.

Bridge 7.0

per; a save feature lets you recall and replay your favorite games.

Artworx improved bidding significantly in this version. The program recognizes the Blackwood and the Stayman conventions, and you can choose weak or strong two-bids. If you aren't sure what to bid, click the hint button for a suggestion. You can also set

your partner and opponents to bid cautiously, normally, or aggressively. A digitized voice vocalizes the bids, but it's a little muddled on my computer.

Game play has also improved. Bridge 7.0 is probably a more skillful player than the other two packages we reviewed. It knows how to finesse and set up a cross trump, and it plays a mean no-trump hand. Redo, Claim, and Concede buttons make playing a

breeze, although you can't check the validity of the latter two. An undocumented feature lets you type "auto" at any place in the game and the software will take over. If necessary, it will bid the hands and then skillfully play them out. This feature makes Bridge 7.0 an excellent teaching aid for beginners; more advanced players will find it useful for comparing strategies.

Like all of the programs,

Bridge 7.0 has its flaws. The automatic mode should be documented, and the right mouse button badly needs fixing. If you click that button, you'll abandon the hand and return to the main menu without receiving a confirmation.

Although the digitized card images are sharp and crisp, other aspects of the graphics can be annoying. During bidding, for instance, South's hand appears at the top of the screen—normally the position of North's cards. The mouse cursor is also confined to the bidding box, which means you can't drag the arrow across the cards as you count points. Other peeves: A played card is displayed in the hand and duplicated on the table until the screen is repainted at the end of each trick (other programs repaint after each card); the cards are arranged in a jiggled fashion rather than neatly aligned; and the backs of the opponents' cards are not visible during play. I admit these are personal preferences, but they detracted from an otherwise excellent product.

Bridge 7.0, \$49.95. Requires: 640K memory, DOS 3.0 or later; mouse recommended. Artworx Software Co., Inc., 1844 Penfield Rd., Penfield, NY 14526; 800-828-6573, 718-385-6120; fax, 718-385-1603. Circle 462 on reader service card.

GRAND SLAM BRIDGE II

Grand Slam Bridge II is an update of the popular game Electronic Arts introduced in 1986. EA has added 256-color VGA graphics, mouse support, and advanced dealing features. The bidding and play are unchanged and as good as they were in the previous version.

This program has every feature and option you can imagine. It can display cards as

■ TSN's On-Line Bridge: *The Social Card Game*

If you enjoy computer bridge games but miss the socializing, there's a cybernetic solution. The Sierra Network (TSN) is a fast-growing on-line service that specializes in real-time, interactive, multiplayer entertainment. Bridge and Hearts are two of the network's most popular basic offerings.

With a computer, a modem, and a TSN account that costs \$12.95 a month, you can play bridge from the comfort of your keyboard at virtually any time of day or night. Your partners are real people from across the country. There are even international players. On a recent evening I counted 12 games with participants from 11 states, including West Virginia, Connecticut, California, Washington, Georgia, and Florida. The players ranged in age from 22 to 72, but most were thirty- or fortysomething.

Before you begin playing, you must create a cartoonlike image of yourself, using icons supplied by TSN. Your partners at the bridge table see this character on their screens. You can include your age, hobbies, and hometown if you want (and you can depict your features as accurately—or inaccurately—as you choose). Once you've logged on (usually through a local telephone number), you can chat with people in the waiting room until you find an agreeable foursome. Then it's

off to a private room to play bridge.

Electronic bidding and playing closely resemble the real thing. You talk by typing messages and play a card by picking it with the mouse. Everyone sees the cards being played and can read everybody else's messages, so there's no "talking under the table." The pace is slightly slower than at a real bridge table because of a delay in the communications network, but at 10 to 15 seconds per trick, the delay is bearable.

People in the waiting room can ask to watch your game—to look over your electronic shoulder—and in this way gain valuable experience. In fact, there is no better or more enjoyable way to learn the game. The players I talked to meet regularly on TSN and were as enthusiastic about socializing with people from across the nation as they were about playing bridge. Now if

someone could just figure a way for the dummy to serve refreshments.

The Sierra Network, \$12.95 per month for up to 30 evening and weekend hours. Requires: 512K memory, DOS 3.0 or later. The Sierra Network, P.O. Box 1550, Oakhurst, CA 93644; 800-743-7721, 209-642-0700; fax, 209-642-0888.

Circle 466 on reader service card.



Ken0—over whose shoulder we are looking—is about to trump Rodi's Ace. On TSN, players from California, Florida, and Georgia meet at the same electronic table.

Grand Slam Bridge II

symbols on a white screen like the notation found in newspapers, or in a colorful 3-D image of a card table. If your system has less than 560K of free memory, however, the program defaults to the white screen without warning. Sometimes I had a 3-D card table and other times I was playing in symbolic notation: I was puzzled until I realized TSRs were the cause.

You can set dealing options to give the best hand to a particular player or team. You can even build the perfect game, using the hand editor. If neither option suits your play, you can call up Mike Lawrence's Bridge Dealer to guarantee an interesting game. That program, bundled free

with Grand Slam Bridge, specializes in creating complex and subtle tournament and partnership hands; its output can be saved and loaded by GSB II.

Bidding options abound. You can set cue bid, strong two-, four- or five-card major, Jacoby transfer, and something called a gambling three-no-trump. Each team's aggressiveness can be set for least, more, or mo

Playing Grand Slam Bridge It is a lot more fun than setting options and fiddling with features. The cards are large and easy to read, and the play is quick. The software can be set to give suggestions on what card to play, and an undo feature lets you retrieve mis-



A savvy bidder: 3-D Grand Siam Bridge II gives players the most features and options.

played cards. The software supports Sound Blaster, so sound effects for shuffling and dealing are quite realistic. Beginners will benefit from the double dummy mode in which you get to see all the cards as you bid and play.

My one criticism of this program is that the movement

limo, and heads for the famed Binion's Horseshoe, the real-life site of gambling's premiere event, the World Series of Poker. The object is to build your seed money into \$10,000, the entry fee for the Championship—and then conquer some of the planet's best card sharps for the grand prize.

In a typical adventure game, you would scurry around a plethora of screens, clicking on every object that might contain a goody. In the WSOP Adventure, you get your money the old-fashioned way: you gamble for it.

This program provides simulations of slot machines, video poker, and blackjack that mimic exactly the machines on the Strip. The slot machine copy, in fact, duplicates the reels from an actual Horseshoe machine. The blackjack simulator plays with a single deck and reshuffles after the cards have been used. Fledgling card counters—or anyone else with a system—can test their skills against an authentic opponent without risking real money. WSOP Adventure contains three state-of-the-art variations, with limits of \$10 to \$400.

Dealing, like every other aspect of the software, is accomplished speedily. Based on theories devised by three of poker's most respected authorities, the program plays as close to an expert

of the mouse cursor is jerky. I am so accustomed to an instant response from the mouse that I find even a slight delay intolerable. I can't cite objective examples, but Grand Slam Bridge seems to be a more savvy bidder, albeit a less skillful player, than Bridge 7.0. Both are more intelligent than Bicycle Bridge, but less attractive.

Grand Slam Bridge II, \$49.95.

Requires: 640K memory, DOS 3.0 or later; mouse recommended. Electronic Arts, 1450 Fashion Island Blvd., San Mateo, CA 94404; 800-245-4525, 415-571-7171; fax, 415-571-7995.

Circle 463 on reader service card.

POKER

WSOP Adventure: A Gambler's Dream

BY MICHAEL KONIK

In real life, few people return from a weekend in Las Vegas with \$1 million. Indeed, few people return home with much more than the shirt on their back. Thanks to the easy-to-install and hard-to-stop-playing World Series of Poker Adventure, serious gamblers and serious dreamers can take a crack at the big time without blowing their life's savings.

The high-resolution, fully-animated World Series of Poker Adventure (\$59.95) transports players to the world of high-stakes wagering, the "Biggest Game in Town." The player's gender-correct alter ego flies into Vegas with a \$5,000 bankroll, steps into a



Winning principles: World Series of Poker may beat you every time, but at least you're not losing real money.

human as any I've seen. Though it can't learn your individual tendencies as a human player would, the program adheres strictly to winning principles. Beginners and intermediate players will find this a helpful teaching tool; advanced players will find it a challenge.

The WSOP Adventure's crowning achievement is its elaborate tournament format, in which the player battles 215 other entrants in a marathon quest for the \$1 million first prize. Almost every aspect of the real World Series of Poker is identically replicated. Using tips from a comprehensive 62-page booklet and advice given by people in the casino, the poker neophyte could learn to play like a master.

World Series of Poker
Adventure, \$59.95. Requires:
640K RAM, DOS 3.1 or later,
mouse. Mojave Software, P.O.
Box 12353, Las Vegas, NV
89112; 702-433-6842.

Circle 464 on reader service card

WINDOWS GAMES

RoboSport: Strategic Shoot 'em Up For Standalone or Network Fun

BY ERIC BERLIN

American Gladiators has always been a guilty pleasure: It's tough to resist the visceral kill-or-be-killed attitude. Maxis captures this sensation with RoboSport, a Windows game for those who believe strategy games are more mature than shoot 'em ups, but like to see the bad guys blown to smithereens anyway.

This is hi-tech, network hide-and-seek. Program your robots to explore the game's terrain and fire at the robots who get in your way. The catch is that up to three opponents

at other stations are programming their robots at the same time. When all of the robots have been programmed, you view the results in the form of a 15-second movie, then do it again.

Maxis's intuitive interface makes the programming easy. The game continues until one team emerges as the only surviving group or until one team has completed certain goals. In Baseball, for instance, the first team to touch all four bases wins. Capture The Flag is the classic childhood game, except that in this one you use machine guns and time bombs. Teams try to collect

coins for points in Treasure Hunt, or must free their teammate in Hostage.

You can customize nearly every aspect of the game, from the length of each turn to the number and type of weapons

ments include burnt-out ruins, a suburban neighborhood, and the inside of a computer.

Perhaps the best part of the game comes at the end, when you watch the whole movie in its entirety (about three minutes) and relive your past glory. Maxis has created an action-suspense winner—at least until *American Gladiators* starts doing it for real.



A computer motherboard makes a treacherous battleground for the players in RoboSport.

RoboSport,
\$59.95.

Requires: 2MB
RAM, Windows
3.0 or later,

2.2MB disk space. Maxis, 2
Theatre Sq., #230, Orinda, CA
94563; 800-336-2947, 510-254-
9700; fax, 510-253-3736.

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Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Bill Howard

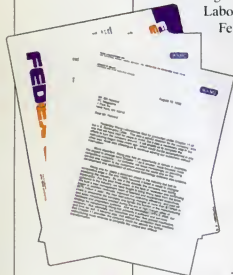
Maybe This Is Why Wang Went Chapter 11

To announce it had run out of money and was filing for bankruptcy, Wang

Laboratories sent by Federal Express priority overnight service

two-page explanatory letters from chairman Richard W. Miller to editors and writers. *PC Magazine* received multiple copies of the bankruptcy letter, each one sent in a separate FedEx envelope that cost \$15.50 (list price).

Fortunately, FedEx gives volume discounts.



 We had a billion dollars in the bank, and now we have none. Wonder where it all went?

Press Releases We Never Quite Finished Reading (International Division)

"The ninth edition of the Iberian Data Processing Professionals Convention, CIBI 92, will be held within the framework of the International Conference on Data Processing (CII 92) to be held from 17 to 20 November in Madrid coinciding with the SIMO Fair..."

—CITEMA (Centre for Data Processing, Tellmatics and Related Media) press release

Help Wanted

"Computer Entry Person with Aldus, Pacemaker and Scanner exp. required."

—CALGARY (Alberta) *HERALD*, August 26, 1992



 This Best Buy Stores ad says the PC comes with GeoWorks Ensemble, but from here it looks a lot like Windows.

PETER NORTON'S PC PROBLEM SOLVER: The Guide for the Everyday User by Peter Norton and Robert Jordan
Anyone who's ever been stumped by *obiter dictum* or *anxius mirabilia* or wondered when to use *i.e.* or *or* will find the answers in this guide to more than 1400 Latin words and phrases. 610 pages
91-2489 QPB \$23.95 5, 30

AMO, AMAS, AMAT AND MORE: How to Use Latin to Your Own Advantage and to the Astonishment of Others by Eugene Ehrlich • Introduction by William F. Buckley, Jr.
This indispensable PC reference book—for IBM and compatibles—shows which commands you really need, how to tailor DOS to your hardware and software, plus how to set up printers and modems accurately and quickly. 328 pages.
62-2257 QPB \$10.95 2, 12

PARTRIDGE'S CONCISE DICTIONARY OF SLANG AND UNCONVENTIONAL ENGLISH Edited by Paul Beale from *A Dictionary of Slang and Unconventional English* by Eric Partridge
Filled with 560 entertaining and educational pages of



William F. Buckley we knew was a computer buff, but Peter Norton as master of Latin? It's all in the Quality Paperback Book Club catalog.

Microsoft Also Started Out as a Small Company

Cidex Computer Systems of Hoboken, New Jersey, released InStep, a \$995 program "focused solely on coordinating parades." The company's previous offering was Quack Track 5.0, the "program that annually managers over 115 individual races for The Great American Duck Race."



If your entry is used in *Abort, Retry, Fail?* we'll send you \$50 and a *PC Magazine* T-shirt. Caution: In case of multiple entries, the postmark date, neatness, and completeness of each entry are considered. Winners this issue: Cliff Sawyer (GeoWindows), Don Morberg (pacemaker), Henry Slofsra (Peter Norton on Latin), Don Willmott (InStep).